JUN 1 & 1942

AUTOMOTIVE and Aviation INDUSTRIES

JUNE 15, 1942

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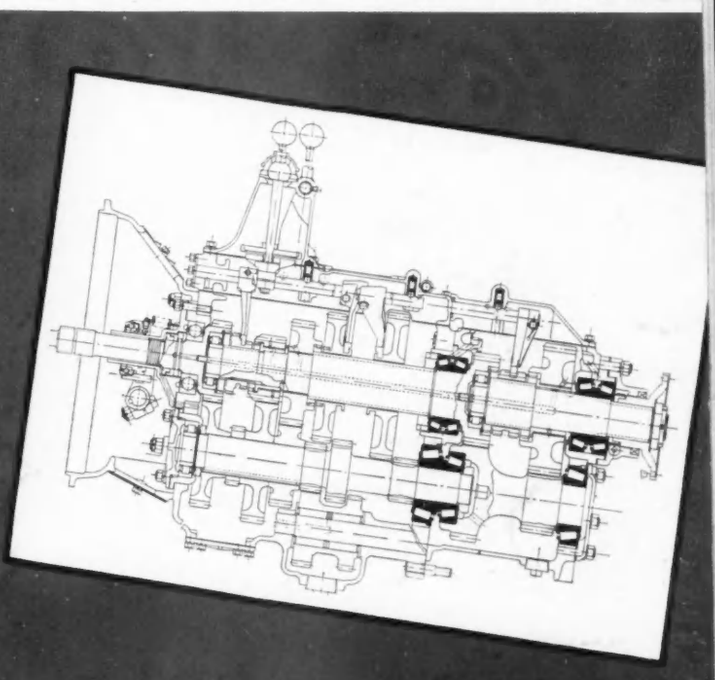

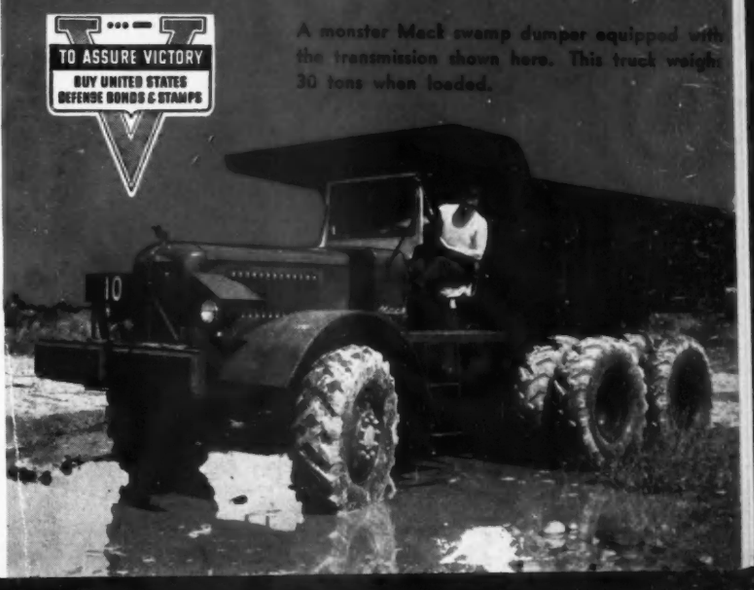

A monster Mack swamp dumper equipped with the transmission shown here. This truck weighs 30 tons when loaded.

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★ SIMPLY
★ QUICKLY
★ INEXPENSIVELY

A truing device can be readily attached to your Heald No. 72A Plain Internal and will permit immediate production on plunge-cut contour grinding jobs, including cartridge dies, etc.

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By following the cam with the diamond holder the wheel can be trued to exactly the same shape, thus permitting plunge grinding the work to the required contour.

Compensaton for wheel wear and truing is provided by means of a knob on the device. Cams are interchangeable, too, and the surface plate adjustable in the bracket T-slot.

Wheels having a wide range of shapes and sizes can therefore be trued for grinding all kinds of contour work.

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By means of the contour truing attachment furnished on this Heald No. 72A Plain Internal form wheels for plunge contour grinding various types of cartridge dies can be easily and quickly trued to the exact shapes desired.

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AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

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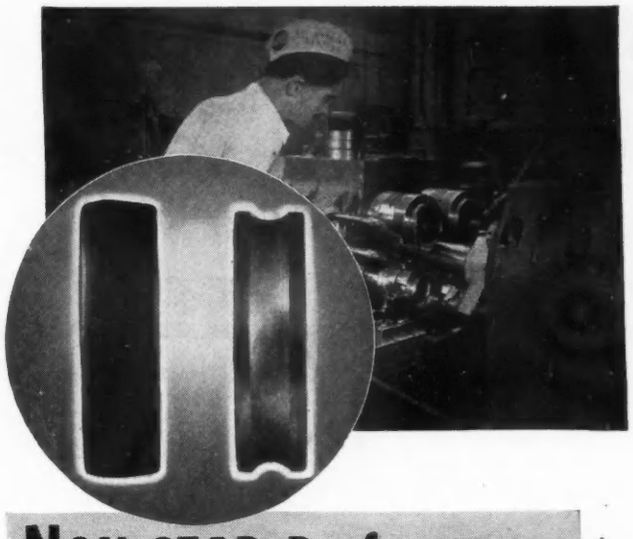

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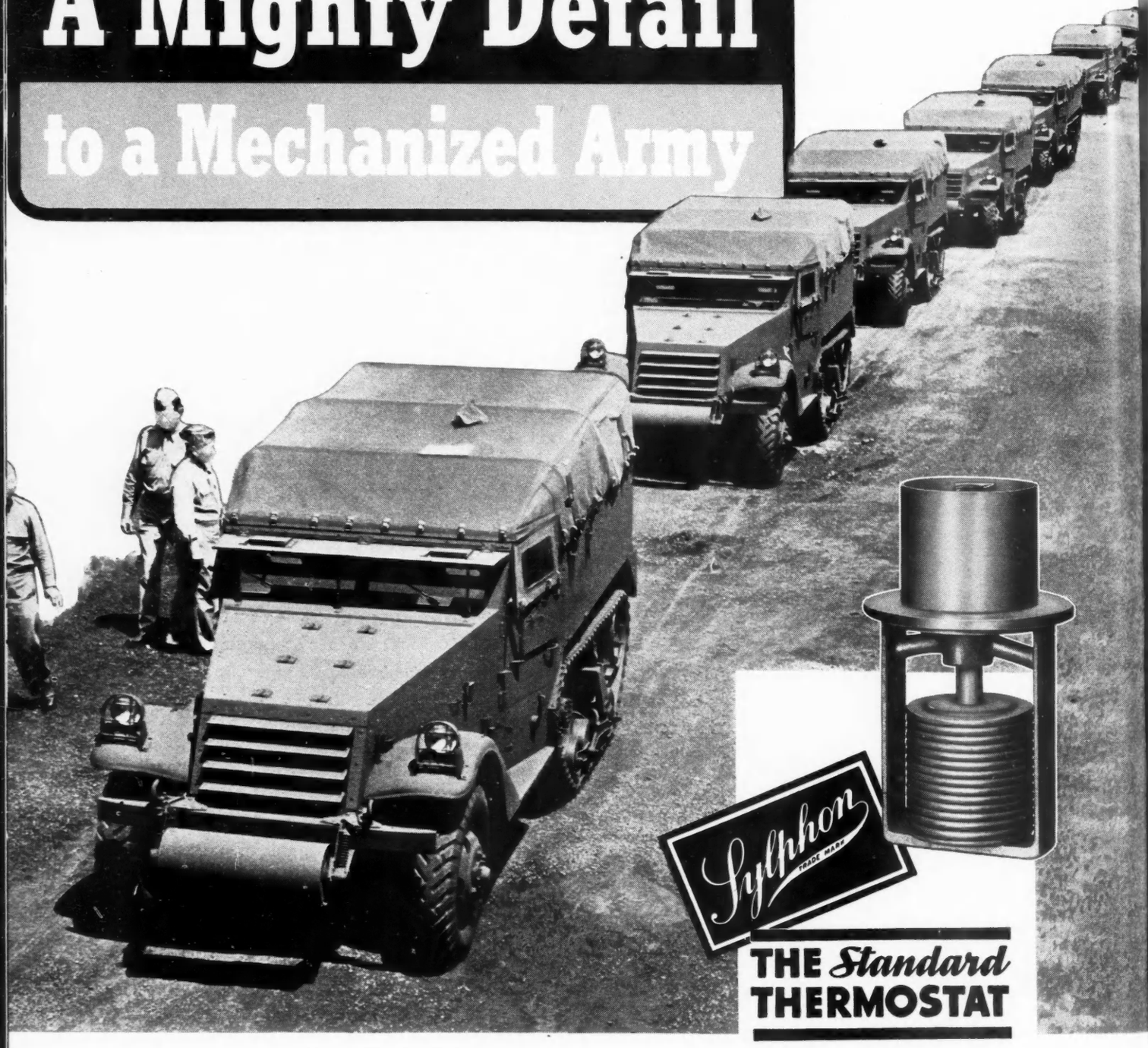
A Mighty Detail

to a Mechanized Army



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A few ounces of metal—yet on it depends the quick striking power of a mechanized army, its endurance under forced "marches", its speed in the field.

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IN THIS ISSUE . . . .

AUTOMOTIVE and AVIATION INDUSTRIES

Volume 86 June 15, 1942 Number 12

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Million Motor Vehicles Operating in Europe

Scarcely more than 1,000,000 motor vehicles are now operating in Continental Europe, or about 16 per cent of the number in use just before the war, a new analysis of the few available facts indicates.

Excluding Russia, only about 600,000 commercial vehicles and perhaps 400,000 passenger cars now remain in operation, of the more than 6,200,000 that were counted in Continental Europe just before the war in 1939, the Petroleum Press Service of London estimates.

Perhaps two-thirds of the commercial vehicles and a small number of passenger cars are running on alternative fuels, generated from charcoal, wood, or coal. Hence consumption of liquid fuels has been drastically curtailed from about 85,000,000 barrels to about 10,000,000 barrels a year. If these figures are correct, and if production of liquid fuels is the maximum estimated, 125,000,000 barrels a year, the Nazis have more than 110,000,000 barrels a year to dole out to their armed forces and industrial plants.

Make Every Pay Day

"BOND DAY"

Get back of the Pay-Roll Savings Plan by encouraging employees to turn part of their earnings *regularly* into tanks and planes and guns through systematic purchase of

U. S. WAR BONDS

Scrap Salvage Now a Major Operation 17

A brand new element has crept into the production of airplanes. Salvage has brought out new techniques and is saving for other uses a percentage high in the nineties.

British Halifax II Bomber 20

Here is a description of a plane that is doing so much in the war. Complete with illustrations, detailed drawings that explain to a large degree the formidable threat that it proves to be to the enemy.

Propeller Blades from Seamless-Steel Tubing 28

Much has been printed about the production and design of propellers but here is a method that is brand new. New in material; new in method of production—in fact it is all new so it should be a must on your reading list.

Rubber Substitutes—Plans for Large Scale Production 32

This is an article that starts from the beginning and carries the reader right through the very objectives in view. It is complete in many details and gives an all around picture of a situation that is highly important at this time. To be well informed, read it.

New Airplanes in the Red Air Fleet 38

Information of this sort is extremely difficult to get out of Russia. However, here is some complete with drawings and description that gives a good picture of the advances that the Soviet has been making.

Rationing and the Passenger Car Stockpile 41

With restrictions and rationing and the many other regulations that we have or do not have, an article of this sort, that lays all the facts out on the table to be inspected, clarifies one's thinking. It has been well done and you should read it.

* **Surge**—the extra stresses which result when the vibration frequency of a rapidly oscillating spring coincides with its natural frequency.

To reduce the dangerous effects of surge, valve springs must be specially designed and carefully fabricated. Rigid tests are equally important, and Muehlhausen engineers use a machine of exclusive design for this purpose. Typical operating conditions are created, and springs are then oscillated at all speeds — from idling to "wide open" motor. At the same time, stroboscopic equipment is used to "stop motion"—and permit visual study at all stages. Thus, any tendencies toward surge are quickly detected.

You can always depend upon Muehlhausen to produce springs of unvarying precision and accuracy. Feel free to check on any phase of spring design, on any type spring—compression, extension, torsion, or flat—hot or cold formed.

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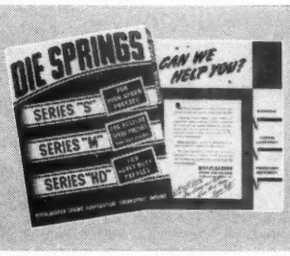
- New Die Spring Bulletin illustrates, describes 206 sizes and types of die springs.
- New Armament Bulletin shows importance of springs for many types of war equipment.



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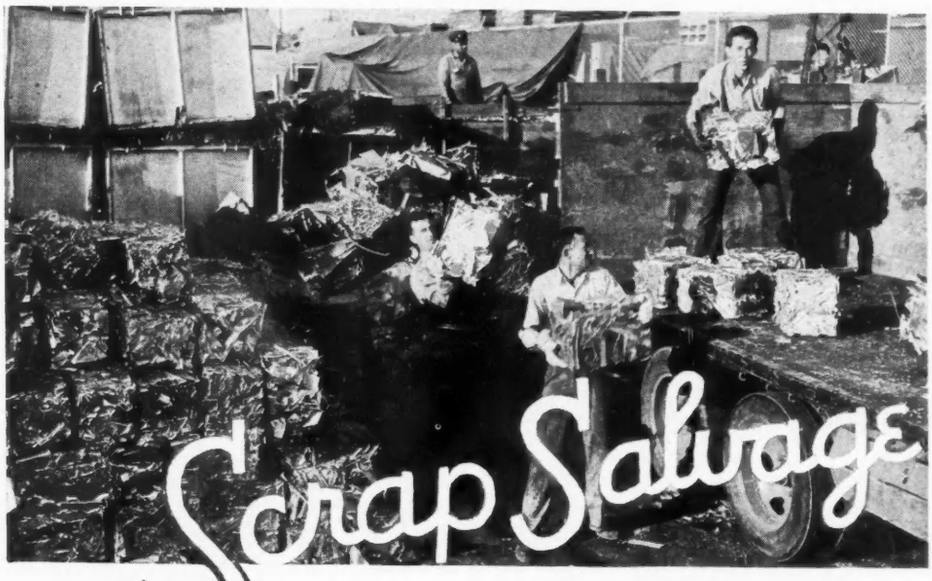


By
R. Raymond Kay

Now a Major Operation at West Coast Aircraft Plants

THE PROBLEM of salvaging scrap metal has molded the entire West Coast aircraft industry to a single purpose to reduce and eliminate waste of vital war materials. At both Boeing and Douglas it is estimated that more than a million dollars worth of material a year is being rescued from the scrap pile, while at Lockheed 165 workers are employed in the salvage department. It is fortunate that in most metallurgical reclamation the recovery is practically 100 per cent.

A WPB official recently estimated that 32 per cent of all the aluminum and magnesium that is delivered to an aircraft manufacturer goes into the scrap bin. On the face of this statement it would seem that the aircraft industry is wasteful. Yet, this tremendous amount of scrap cannot be avoided today, for almost every operation in an aircraft plant's primary shops —where the material is cut up—creates trimmings, ends, and metal sawdust. The aircraft industry is peculiar in having tools that require a certain amount of excess material. The hope of eliminating this great percentage of scrap lies in better planning, coordinating tooling and manufacturing processes with dimension of purchased material, plus recourse to optional gages, concentrated nesting of sheet stock parts, and the theory that an ounce of prevention in design and method is worth a pound of scrap in the bin.

In March, 1942, North American Aviation's savings of scrap metals showed an increase of 139 per cent over the average of the previous eight months. The reason for this greater utilization of materials was the inauguration of an integrated material conservation program. What formerly was a series of individual attempts by departments to do something about the problem, became a definite program, incorporating under one office the functions of conservation and reclamation.

Segregation of valuable metal scrap is begun at the machines where the metal is worked. Throughout the shop are scrap containers marked with colored bands to indicate what metal goes into each. An educational program impresses the importance of saving all metals and the necessity for segregating scrap at the machines so that the metal can be reclaimed efficiently.

All metals are saved, and are immediately segregated. At present, the metals being segregated at the machines are aluminum, and aluminum alloys (broken down into 24S bare, 24S painted, 52S, 2S, and other

Small parts are classified, inspected and weighed in this department at Lockheed before returning them to stock.

grades mixed), magnesium, and steel (segregated into stainless, chrome-molybdenum, nickel, low carbon, and high-speed tool steel.) Of the other metals, aluminum-and phosphor-bronze, brass, and copper are segregated.

North American's salvage program is aimed at the elimination of all waste, and at present cutting and lubricating oils, paper, fabric, and other materials are being reclaimed for use again in the plant or segregated for resale.

Lockheed-Vega has instituted a series of graph charts to enable supervisors and workmen to better visualize the waste of materials. The mixing of materials has been a wasteful condition, but under the new plan Lockheed, at two of its plants, has reduced the volume of mixed bolts, nuts, screws, rivets and other components as much as 80 per cent.

During the past three years Lockheed has accumulated duralumin and steel parts consisting of everything from the smallest rivet up to the heaviest of nuts and bolts, totaling approximately 100 tons and having an average cost of about $2.50 a pound. This represents a tremendous amount of material formerly lost to the company, but now salvaged. A local company takes the sweepings, just as they get them from the floor, and with special equipment and hand-sorting, they reclassify and return to stock all usable parts that were not damaged in collecting and handling. These are being returned at the rate of about one and one-half tons per week.

Sorting and reclassifying the mixed rivets that have been thrown on the factory floor and accumulated in material conservation boxes is now being done mechanically. The cost of segregation ranges from 50 cents per pound for the small 3/32-in. rivets, down to 25 cents per pound for the larger ¼-in. rivets.

Another phase of the factory material conservation at Lockheed-Vega is being carried on in the sheet metal fabricating departments with the assistance of the plant engineering department. Walter White, salvage survey department manager, states:

"We are changing templates to reduce the blank sizes to a minimum, changing drop hammer dies, punch press dies, shear sizes on the master route sheets in the manufacturing engineering department, changing materials and substituting to enable us to use all the odds and ends from the shear section, securing changes for more economical fabrication both in material and labor."

Lockheed is improving the plant layout to facilitate the flow of material from the rack stock to the assembled plane, and is constantly experimenting and revising the processing of materials to such an extent that in the past three years waste material has been reduced approximately 45 per cent.

Vultee's materials conservation department saves some 25,000 pounds of material weekly. The latest development of the conservation program is the installation of a magnetic separator to salvage usable material from the floor sweepings of all assembly departments. The magnetic separator was developed by Vultee, and is the only one now in use by an aircraft company. It is capable of sorting 600 pounds of material per hour, and at the same time, blowing it free of dust and cleaning it.

Some 8000 pounds of useable small production items are recovered weekly by running floor sweepings through the magnetic separator. Janitors have been in-

At the Douglas plant thousands of pounds of scrap sheet metal are pressed into bales after sorting.

Through this magnetic separator developed by Vultee in conjunction with Schafer Electric Co., all floor sweepings containing metal are handled in a manner somewhat like classifying sand and gravel through a trommel. Extraneous material is discharged into waste cans at the end, while parts to be segregated for return to production or salvage are collected in hoppers at the side.

structed to put all sweepings which contain metal, into labeled cans. They are routed to the salvage section of material conservation. These floor sweepings are then dropped into a hopper at the end of the magnetic sorter, which makes several separations. It separates the ferrous from the non-ferrous metal. There is a blower connected which eliminates the rivet and other drillings, that are no longer useful. Inside the machine is a series of different sized meshes. A rubber belt passes over a magnetic pulley and forces the rubbish

From this spar milling machine and others at the North American factory, large quantities of trimmings are salvaged daily.

tables the material is separated into rivets, nuts, bolts, etc., and into separate receptacles through holes in the table top. Then a girl takes all rivets and separates them into sizes and kinds. Other girls do the same with the other items. The material is inspected and only damaged pieces are scrapped for salvage. All useable material goes back into production. Becoming expert in the han-

(*Turn to page* 68, *please*)

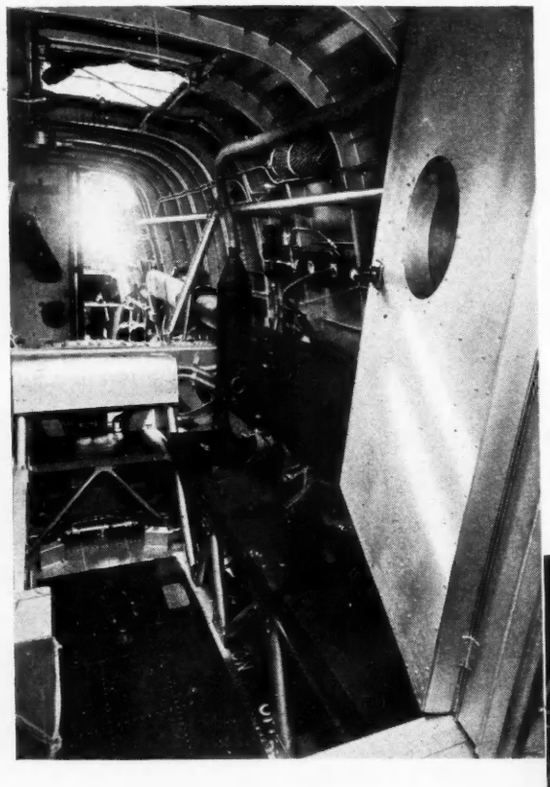
out the other end. Rivets fall through the smaller meshes at one end of the machine, and nuts, bolts, etc., pass on a little way and fall through larger meshes into boxes at the side of the machine.

The material thus saved goes into a series of sorting tables for final sorting. At the sorting

These salvage sorters are segregating small parts recovered from the sweepings at the Lockheed pant.

British Halifax II Bomber

This heavy, four-engined warplane can carry 6½-ton bomb load and is equipped with eight Browning machine guns in three turrets



(Above) The crew's rest station is located ahead of the dorsal turret. At the top can be seen the front escape hatch.

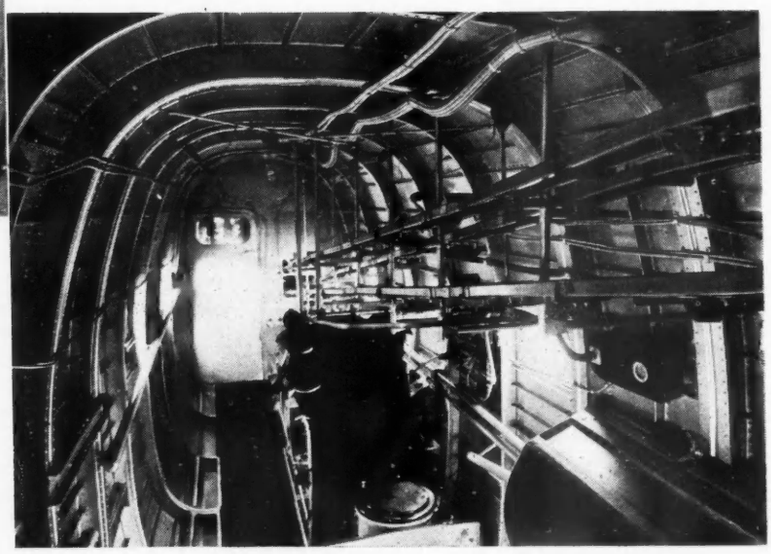
Courtesy of *Flight* (London)

(Right) Looking aft through the rear fuselage section. Note the ammunition conveyors to the four-gun rear turret.

Courtesy of *Flight* (London)

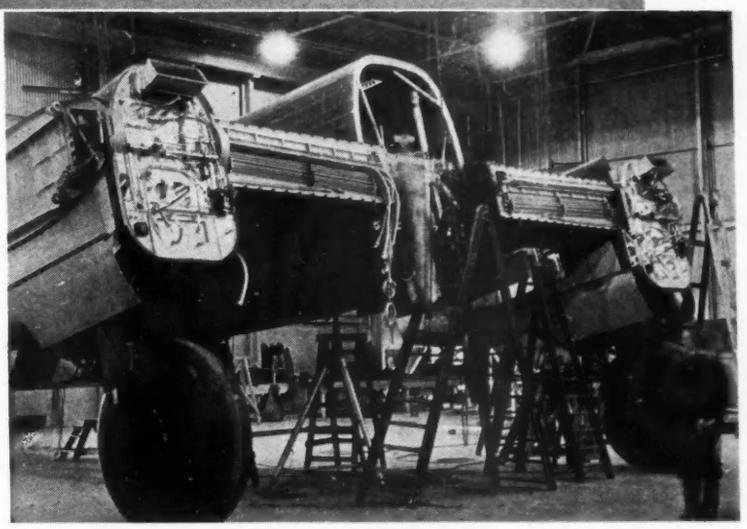
ALTHOUGH it first went into production towards the end of 1940, specifications and descriptive data have been released but recently for the Handley Page Halifax II heavy bomber, which is said to carry a bomb load of 6½ tons on long range raids. Complete performance figures have not been released, but it has been made known that, lightly loaded and stripped, it is capable of approximately 300 mph at rated height and has a range of around 3000 miles. It has four Rolls-Royce Merlin XX engines (see AUTOMOTIVE and AVIATION INDUSTRIES, May 1, 1942), three power-operated multi-gun turrets and carries a crew of seven.

Originally it was laid out to the same Air Ministry specification as the Avro Manchester with two Rolls-Royce Vulture engines, but later at the request of the Air Ministry, it was modified to take four Merlin X engines, with



Courtesy of *The Aeroplane* (England)

By
M. W. Bourdon
Special Correspondent of
AUTOMOTIVE *and* AVIATION
INDUSTRIES in Great Britain

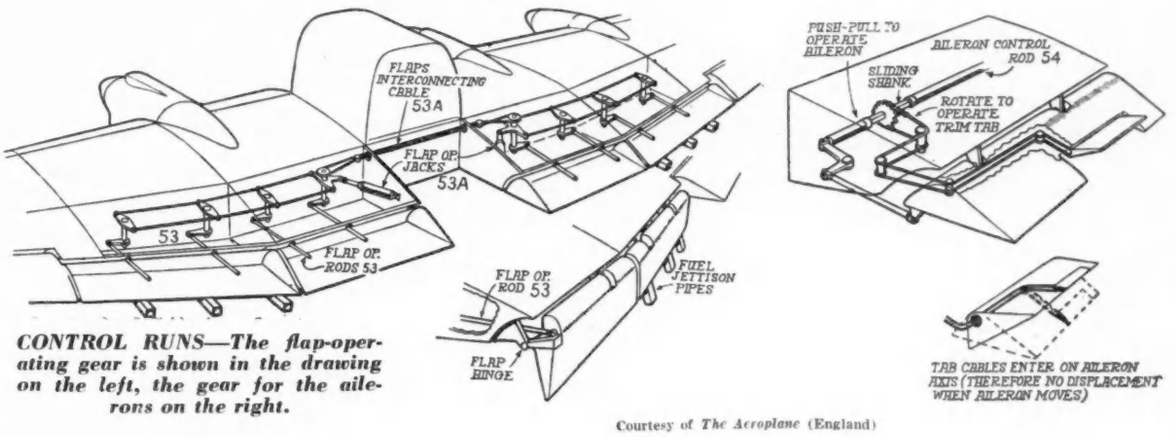


Central section and inboard engine mountings of a Halifax II bomber in course of assembly.

increased wing span, lengthened fuselage and the loaded weight increased from 26,000 lb to 40,000 lb. Later still, the loaded weight was increased further to 60,000 lb and the type designation became Halifax II with Merlin XX engines, each developing 1175 hp at 20,500 ft., enabling the maximum speed to be the same as the lighter Halifax I.

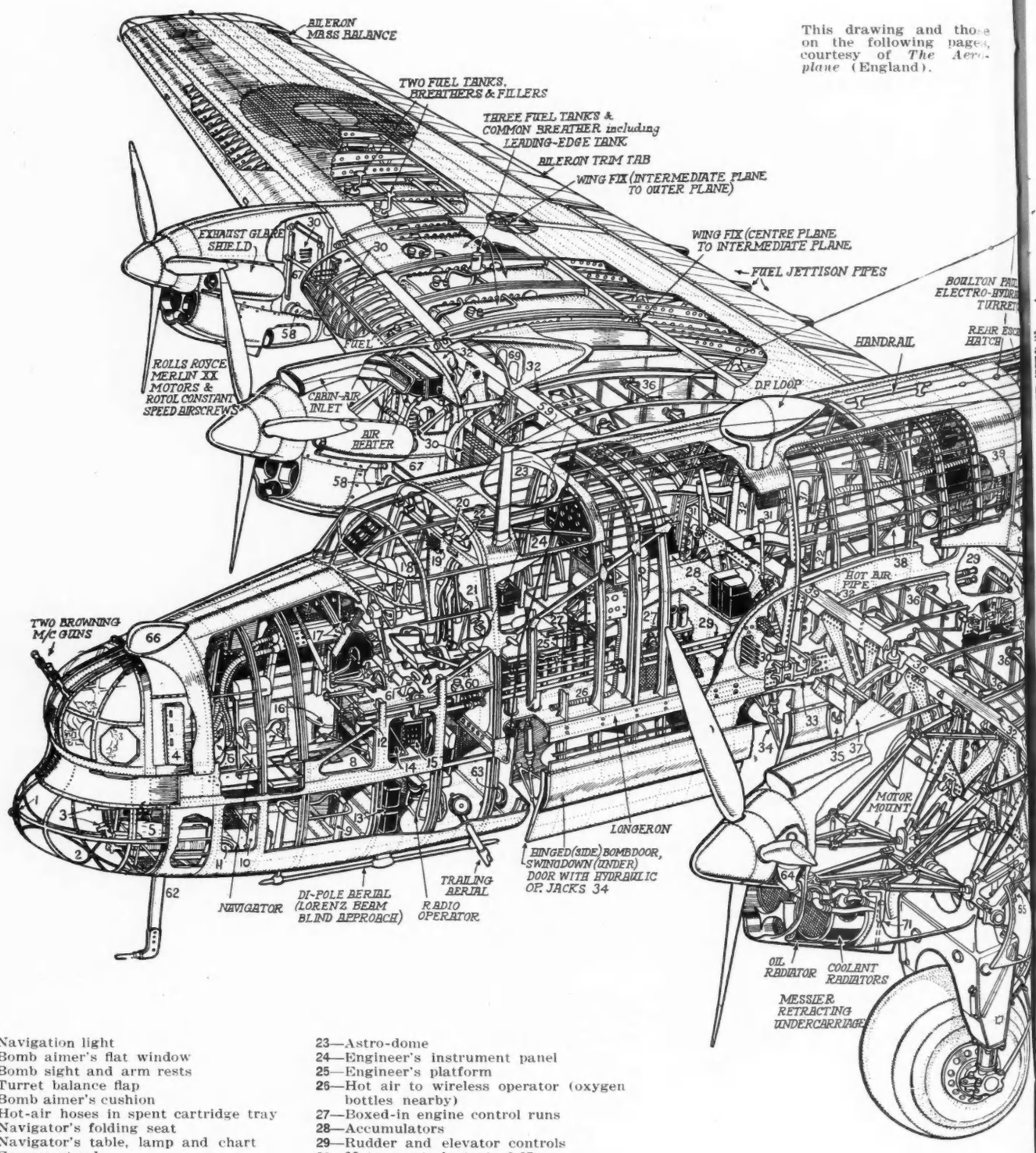
It is a mid-wing monoplane with twin fins and rudders, and is built on a split assembly system, which divides it into a number of units convenient for transport and repair, as well as enabling a large number of people to work on each machine simultaneously, with benefit in more rapid output. There are 24 major assemblies, each formed of a varying number of sub-assemblies, and the successive assembly and sub-assembly jigs are so planned as to represent successive operations occupying the same time and thus securing an unbroken flow throughout the twin assembly lines.

Detailed drawing on two following pages. Description continued on page 24


FLAPS INTERCONNECTING CABLE 53A
FLAP OP. JACKS 53A
53
FLAP OP. RODS 53
FLAP OP. ROD 53
FUEL JETTISON PIPES
FLAP HINGE
PUSH-PULL TO OPERATE AILERON
AILERON CONTROL ROD 54
SLIDING SHANK
ROTATE TO OPERATE TRIM TAB
TAB CABLES ENTER ON AILERON AXIS (THEREFORE NO DISPLACEMENT WHEN AILERON MOVES)

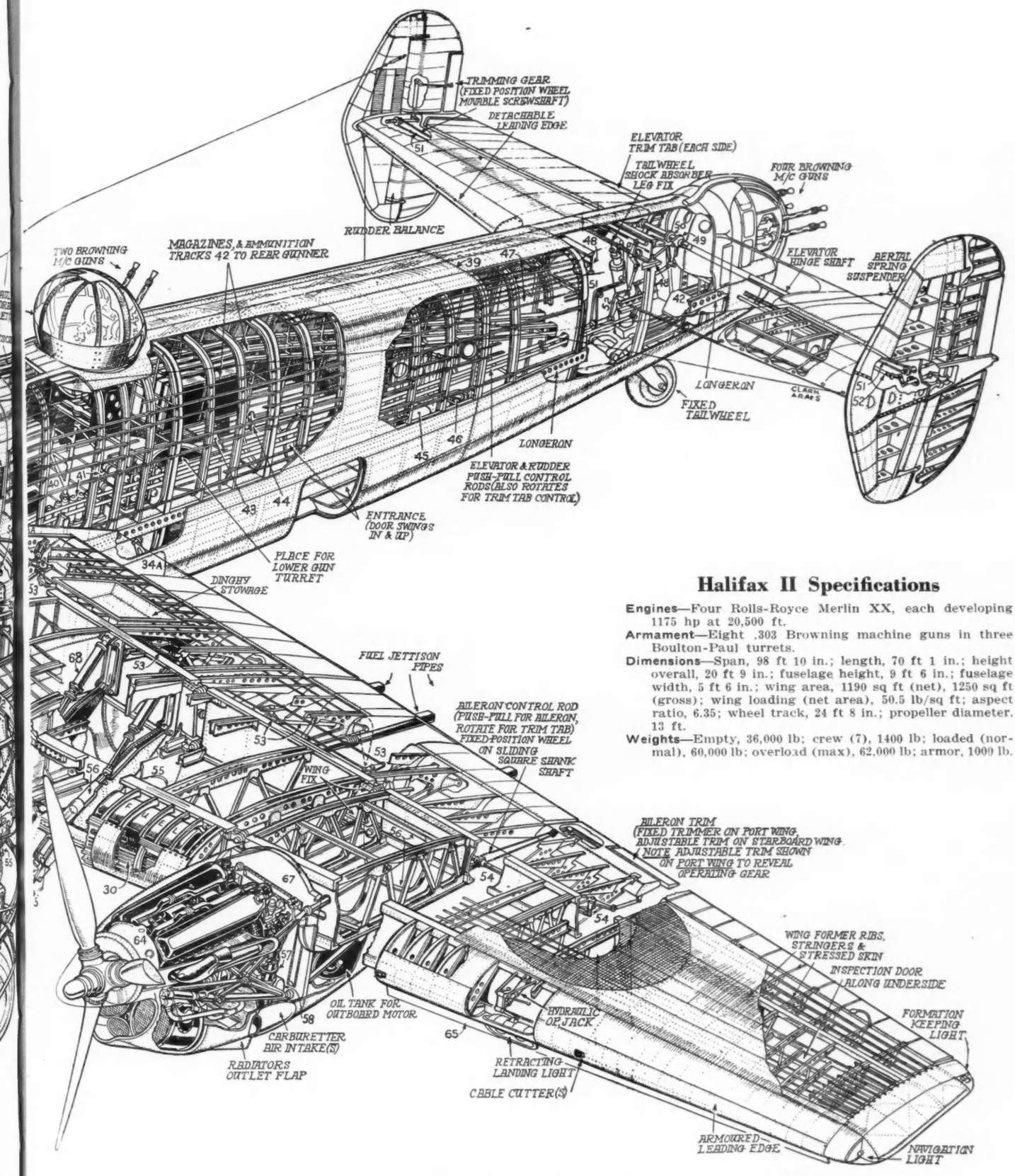
CONTROL RUNS—The flap-operating gear is shown in the drawing on the left, the gear for the ailerons on the right.

Courtesy of *The Aeroplane* (England)



This drawing and those on the following pages, courtesy of *The Aeroplane* (England).

1—Navigation light
2—Bomb aimer's flat window
3—Bomb sight and arm rests
4—Turret balance flap
5—Bomb aimer's cushion
6—Hot-air hoses in spent cartridge tray
7—Navigator's folding seat
8—Navigator's table, lamp and chart
9—Camera stand
10—Parachute stowage
11—Gyro azimuth stand
12—Repeater compass
13—HT and LT units (radio)
14—Transmitting and receiving sets (radio)
15—Main electrical panel
16—Step-up to pilot's cockpit (parachute stowage underneath)
17—Main instrument panel, engine controls
18—Folding seats (second pilot and engineer)
19—Fuel cock controls
20—Motor starter buttons
21—Emergency flare releases
22—Sextant rest
23—Astro-dome
24—Engineer's instrument panel
25—Engineer's platform
26—Hot air to wireless operator (oxygen bottles nearby)
27—Boxed-in engine control runs
28—Accumulators
29—Rudder and elevator controls
30—Motor controls (out of 27)
31—Emergency hydraulic hand pumps and hydraulic accumulators
32—Hot air trunks from heater on inboard motors
33—Lower spar boom
34—Bomb door hinges and op. jacks
34a—Rear hinge, no jack
35—Doors to wing bomb cells
36—Wing bomb door operating rods and jack
37—Leading edge section
38—Rest bunk each side
39—Jointing frames
40—Step up to turret
41—Flame floats and sea markers
42—Ammunition tracks
43—Flare chutes
44—Emergency axe stowage
45—Elsa lavatory
46—D/R compass
47—Bulkhead and door to tail gunner
48—Tailplane fixings
49—Elevator hinge lever
50—Elevator control lever
51—Rudder trim controls
52—Rudder control rods
53—Flap controls and op. jack
53a—Interconnecting wires (port to starboard flap)


TRIMMING GEAR (FIXED POSITION WHEEL MOVABLE SCREWSHAFT)
DETACHABLE LEADING EDGE
ELEVATOR TRIM TAB (EACH SIDE)
TAILWHEEL SHOCK ABSORBER LEG FIX
FOUR BROWNING M/C GUNS
RUDDER BALANCE
TWO BROWNING M/C GUNS
MAGAZINES & AMMUNITION TRACKS 42 TO REAR GUNNER
ELEVATOR HINGE SHAFT
AERIAL SPRING SUSPENDER
LONGERON
CLARK ARMS
FIXED TAILWHEEL
LONGERON
ELEVATOR & RUDDER PUSH-PULL CONTROL RODS (ALSO ROTATES FOR TRIM TAB CONTROL)
ENTRANCE (DOOR SWINGS IN & UP)
PLACE FOR LOWER GUN TURRET
DINGHY STOWAGE
FUEL JETTISON PIPES
AILERON CONTROL ROD (PUSH-PULL FOR AILERON, ROTATE FOR TRIM TAB) FIXED-POSITION WHEEL ON SLIDING SQUARE SHANK SHAFT
WING FIX
AILERON TRIM (FIXED TRIMMER ON PORT WING, ADJUSTABLE TRIM ON STARBOARD WING. NOTE ADJUSTABLE TRIM SHOWN ON PORT WING TO REVEAL OPERATING GEAR
WING FORMER RIBS, STRINGERS & STRESSED SKIN
INSPECTION DOOR ALONG UNDERSIDE
FORMATION KEEPING LIGHT
OIL TANK FOR OUTBOARD MOTOR
HYDRAULIC OP. JACK
CARBURETTER AIR INTAKE(S)
RADIATORS OUTLET FLAP
RETRACTING LANDING LIGHT
CABLE CUTTER(S)
ARMOURED LEADING EDGE
NAVIGATION LIGHT

Halifax II Specifications

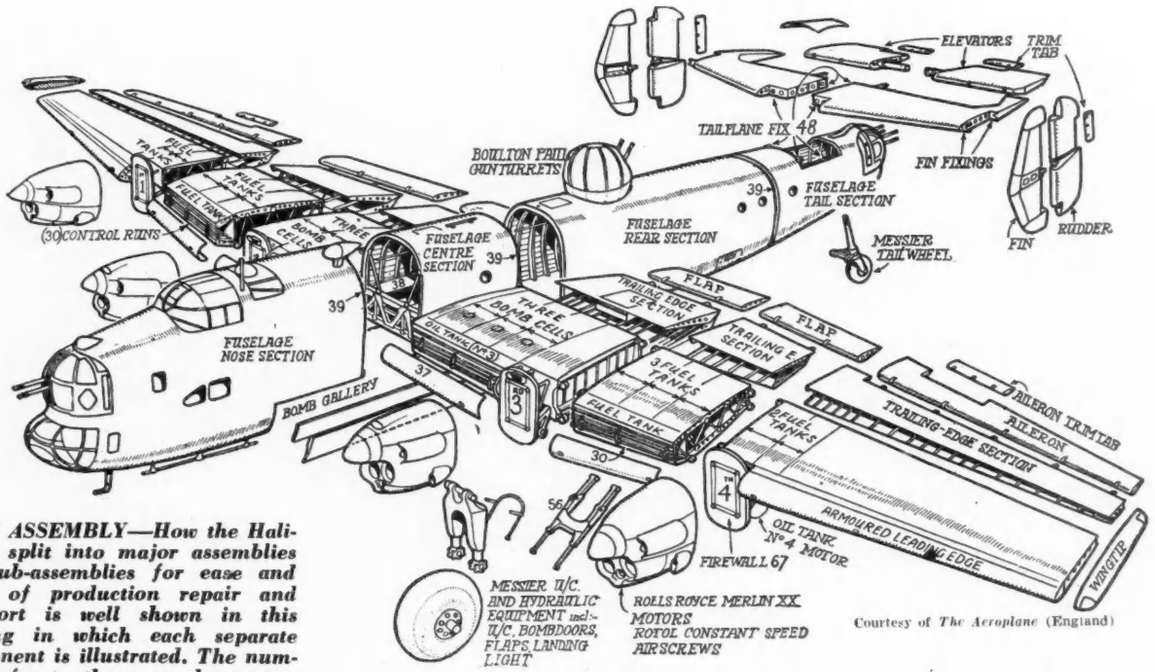
Engines—Four Rolls-Royce Merlin XX, each developing 1175 hp at 20,500 ft.

Armament—Eight .303 Browning machine guns in three Boulton-Paul turrets.

Dimensions—Span, 98 ft 10 in.; length, 70 ft 1 in.; height overall, 20 ft 9 in.; fuselage height, 9 ft 6 in.; fuselage width, 5 ft 6 in.; wing area, 1190 sq ft (net), 1250 sq ft (gross); wing loading (net area), 50.5 lb/sq ft; aspect ratio, 6.35; wheel track, 24 ft 8 in.; propeller diameter, 13 ft.

Weights—Empty, 36,000 lb; crew (7), 1400 lb; loaded (normal), 60,000 lb; overload (max), 62,000 lb; armor, 1000 lb.

54—Aileron controls
55—U/C doors and op. jack
56—Fuel tank supports
56a—Undercarriage bungee device
57—Carburetor air intake
58—Glycol tank (propeller de-icing)
59—Oil tank for inboard motor
60—Rudder trim
61—Aileron trim
62—Pressure head
63—Trailing aerial reel stowage
64—Glycol header tank
65—Inspection door along wing leading edge
66—Cover for turret connections
67—Motor firewall
68—U/C op. jacks
69—U/C and U/C doors accumulators
70—Radiator and landing lamp jack accumulator
71—Radiator jack
72—Landing-Light op. jack
73—Quadrant distributor on engineer's panel 24
74—Distributor
75—Tank { alongside Glycol / tank 58
76—Pump accumulators
77—Engine driven pump
78—Junior distributor



Courtesy of *The Aeroplane* (England)

SPLIT ASSEMBLY—How the Halifax is split into major assemblies and sub-assemblies for ease and speed of production repair and transport is well shown in this drawing in which each separate component is illustrated. The numbers refer to those on the master drawing on the previous pages.

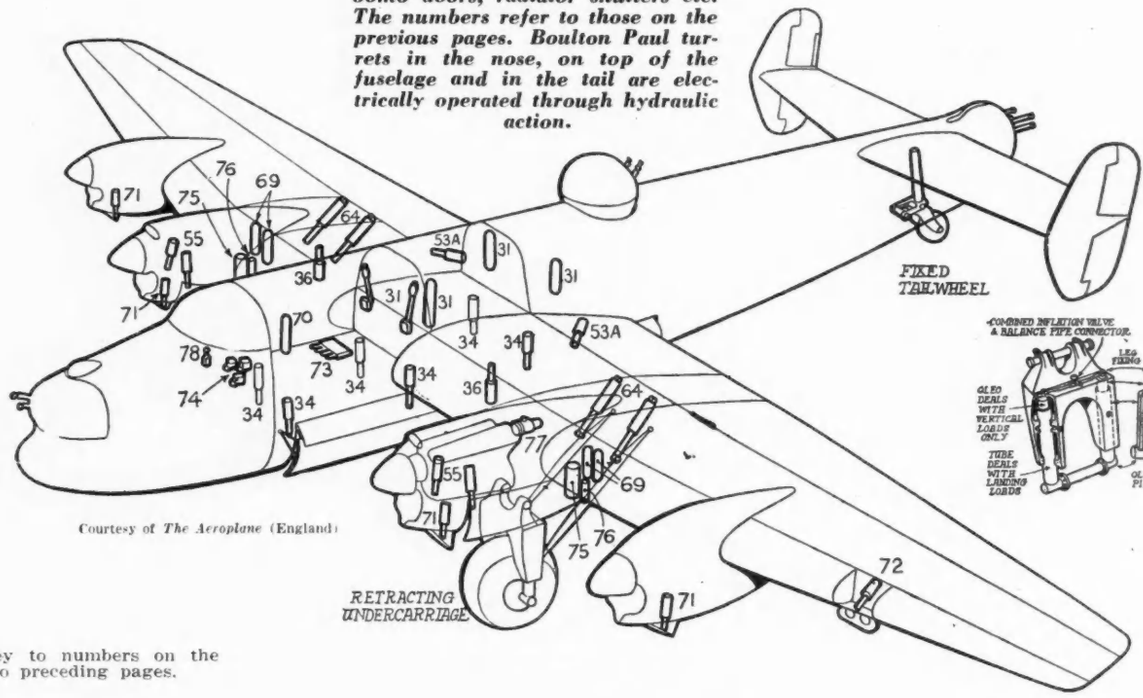
The engines are self-contained units with coolant radiators, oil radiators and mountings ready for attachment to four points on the firewall. Propellers are the Rotol constant-speed full-feathering type and are equipped with wooden blades. Fuel is carried in the wings in 12 self-sealing tanks and can be jettisoned in two minutes through pipes extending beyond the trailing edge of each wing. There are four oil tanks each with a capacity of 41 U.S. gallons.

Unusual provision is made for flame-damping the exhaust. In the first place the exhaust pipes are of special design and themselves reduce the extent of visible flame, while the remainder is hidden by cowls or tunnel shrouds. Although it is agreed that these projections cut down the maximum speed by several miles an hour, it is considered that, in increasing the enemy night-fighter's difficulty of locating the machine, the sacrifice in speed is justified.

On the port inboard engine is a compressor for the power brake system and each inboard engine drives a 24-volt, 1000 watt generator, one for the lighting system and the other for engine-starting, feathering

(*Turn to page* 64, *please*)

HYDRAULICS—Messier hydraulics power all the ancillary service on the Halifax. This diagram keys all the jacks and accumulators for the Messier undercarriage, and the bomb doors, radiator shutters etc. The numbers refer to those on the previous pages. Boulton Paul turrets in the nose, on top of the fuselage and in the tail are electrically operated through hydraulic action.



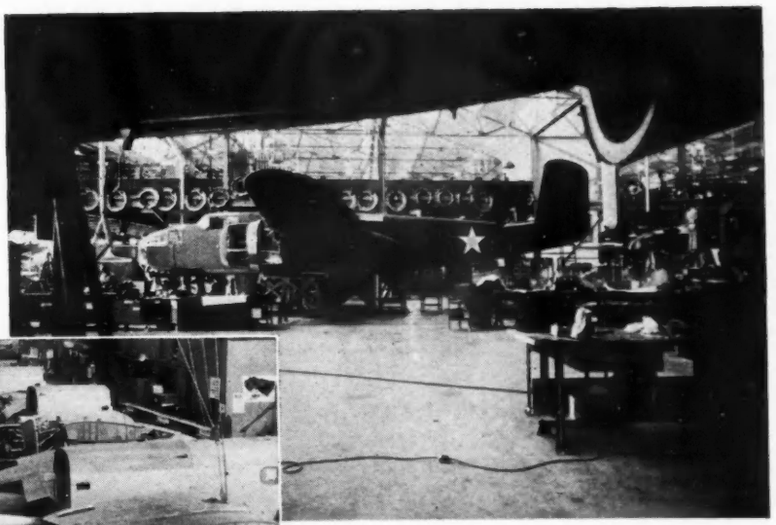
Courtesy of *The Aeroplane* (England)

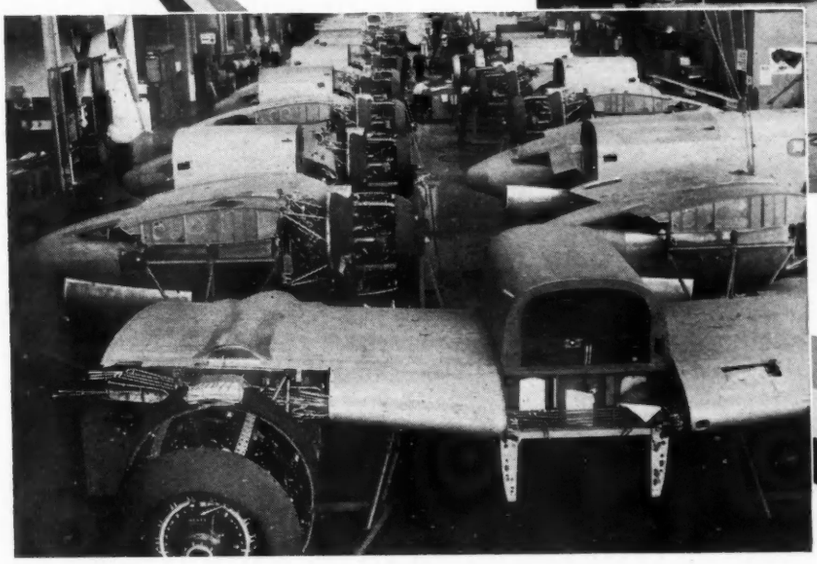
Key to numbers on the two preceding pages.

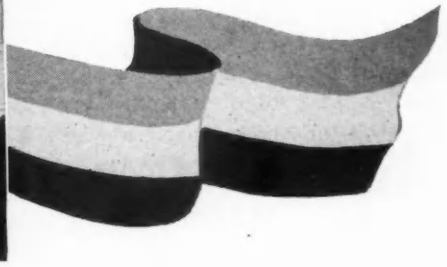
THESE photographs, taken at the plant of North American Aviation, Inc., show the North American B-25 medium bomber in several stages of construction. In the area shown in the photograph at the lower left, motors are installed on the wing center section. Nearing completion, the planes are shifted to "Position 6" (below at right), the last of six positions on the assembly line, where propellers and motor cowlings are installed. Finally, the planes are rolled out on the flight ramp where final inspection tests are made. In the photograph (at top) can be seen planes, easily recognized by their insignia, which are destined to see service in the air forces of (reading from the bottom up) United States Army, Russia, the Netherlands, Great Britain, and the United States Army again.

The North American

B-25 Flies for Many Nations







SCHICKELGRUBER, Benito, and Hirohito may have suspected it all the time. But now they need ponder no longer. American industrial might is all it's cracked up to be. Paced by the automobile industry, American war production is surely striking terror in the hearts of this odious triumvirate. In a report to the nation prepared by the Automotive Council for War Production, there is every indication that, in the few months since Pearl Harbor, production by the automobile industry has been boosted far beyond the brightest hopes of the industry's leaders.

On Dec. 7, the automotive industry's share in the national defense program was an accumulation of war orders totaling about $4 billion. In the succeeding weeks the total grew until the industry's orders exceeded $14 billion—a production job calling for materials and men sufficient to produce 15 million cars and trucks, normally a three years' job.

The industry was asked to build 75 per cent of all aircraft engines, over one-third of the machine guns, more than two-fifths of the tanks and tank parts, more than half the Diesel engines, 100 per cent of the motorized units, and many other items of military equipment. It has not failed.

Attesting to the speed with which conversion was effected, recent reports show that the value of deliveries for the six months ending June 7 was more than $1,400,000,000—equal to one and one-half times the value of all armaments shipped by the industry from the start of World War II in September, 1939, to the attack on Pearl Harbor. Though production rates on individual war products are military secrets, the publishable facts show that THE JOB IS BEING DONE.

When the automotive companies first undertook gun and shell contracts, most of their personnel had never even seen these products in modern versions. Many such weapons and projectiles, in fact, had never been produced in this country. Of others, only a few had been turned out experimentally in government arsenals.

Orders given the automotive plants called for such arms as Browning and Browning-Colt machine guns of several types and calibers, Oerlikon and Bofors anti-aircraft cannon, Hispano-Suiza automatic aircraft cannon, tank and field artillery pieces, carbines, and for a variety of breech blocks and housings, recoil mechanisms, and gun carriages. They called for ammunition ranging from .30-caliber cartridge cases to 155-mm shells and including nearly all sizes and types of projectiles, as well as bombs and torpedoes. Fuses, bullet cores, and shot also were wanted in ever increasing quantities as the United States began to supply the United Nations.

Typically, the first of the automotive companies to enter shell production quickly turned to an automotive technique for handling the job. The company, proving its idea to be workable, readily obtained consent to use the upset-forge process instead of the traditional piece and draw method. After tooling up to produce one million large shells, the company was able to turn out its second million shells in 55 days and its third million in 35 days. Subsequently it clipped additional days progressively from the time requirement.

A passenger car producer, getting an anti-aircraft gun of foreign design into production seven months after receipt of the order, cut four months from the time required by the company that invented the gun and eighty days from the time used by a leading British armaments maker. That record won the company the Navy "E" award. Time and cost were saved when the military endorsed the company's suggestion that the barrel could be broached instead of processed by traditional rifling methods. This cut the manufacturing time for this part to 15 minutes from 3½ hours.

Saving Materials

A parts firm developed equipment that turns out 20 to 30 times as many machine gun components as regular arsenal machinery, operating alongside it, can handle. The same company, working with ordnance and steel company engineers, perfected a specially designed shape of high-alloy steel from which to process barrels. The forged shapes, weighing 47 pounds each, replaced 65-lb billets of steel rod stock.

In the Fall of 1939 an automotive company successfully bid on an order for less than 50,000 trench mortar shells. Starting with this nominal order for shells, the company within eight months became one of the largest suppliers of shells to the Army. Re-

The Job is Being Done

conditioning discarded machinery and converting automotive machines as it went along, by December of 1939 the company had orders for slightly less than 200,000 shells of several sizes and types.

Carload shipments were moving out of its plants during the following March. By July—still in 1940—it was well on the way to turning out 2,000,000 shells. Now it has more men engaged in this production and in other war work than it ever employed during peacetime.

Awarded its first contract for anti-aircraft guns in early 1941, a passenger car company completed the first unit 180 days later. Straight line production was under way 30 days after that. Within a year, shipments were running ahead of original contractual requirements by 1000 per cent. Deliveries now are at a rate exceeding by 30 times the schedule originally planned.

A peacetime producer of shock absorbers, bumpers and other miscellaneous parts started machine gun manufacture in early 1941 —five months after receiving the contract, two months ahead of schedule, and well in advance of the completion of its new arsenal's tooling. Since Pearl Harbor, size of its original order has been increased eight times and the scheduled peak of production for the existing plant has been doubled. Employment on this job has been increased 50 per cent since early December and it will be jumped another 50 per cent by mid-summer.

Automobile manufacturers are out-blitzing the blitzers in the output of war materials

Gun Mounts for Tanks

An appliance factory is producing gun mounts for tank installation and a heater company is turning out machine gun tripods. A brake plant has been making fuses. A stamping shop is turning out anti-tank mines. A gasoline gauge producer is making trench mortar shells. Bomb fins are the principal product of another company.

The automotive industry's ingrained second nature —acquired in the world's most competitive business in peacetime—retained its old force as the automotive companies discarded competition for co-operation for the duration. The resultant efficiencies included some amazing savings. For example, an automatic cannon placed in production 18 months ago cost around $1,200 at that time. Within six months more than $250 had been cut from cost, while today's price to the government is nearly 40 per cent lower—the result of automotive mass production efficiency.

"The United States is now exceeding the Axis in production of tanks."

This statement, made by a high government official in April, 1942, reflects the accomplishments of the automotive manufacturers and others in overcoming the lack of tank-making facilities in this country. In 15 years after the World War, only 30 tanks were built in the United States.

Seven Months Ahead

In the summer of 1940, one automobile manufacturer was asked to build 28-ton medium tanks. As these had never been mass-produced before, the job called for a specially built arsenal.

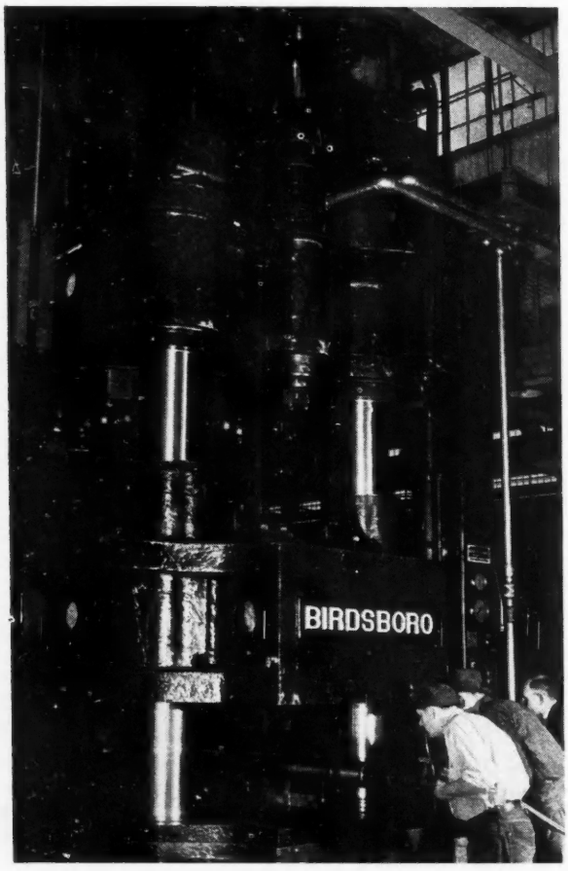
Delivering its first M-3 tank in April, 1941, the company went on to produce the remainer of the tanks called for in the contract some seven months ahead of schedule. Expansions were made to boost the production rate many times above what was originally specified. Today this company has reached capacity output. Although the figure is a military secret, it can be said that the present production rate was not even considered a possibility when the original contract was signed.

The rapid progress that has been made on the industry's tremendous tank undertaking is highlighted by the fact that one company will shortly handle in one day the same amount of materials as were handled in a full month a year ago.

Experiences with the riveted tank in actual battle on the Libyan desert in 1941 resulted in the U. S. Army decision to switch to a new all-welded tank whose surfaces are curved and therefore tend to deflect projectiles. Slightly lower in silhouette than its predecessor, it constitutes a target more difficult to see. Moreover, it mounts its 75-mm cannon in a revolving turret which facilitates fire in any direction of a 360-

(*Turn to page* 56, *please*)

Propeller Blades



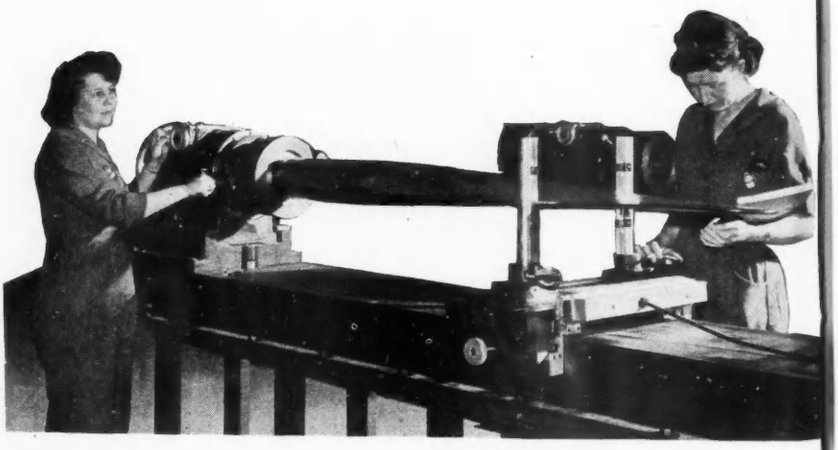
(Above) One of the forming operations on a big Birdsboro hydraulic press. The tube, filled with gas under pressure to assure proper shaping, is formed in a die which may be seen in this view.

THE FIRST mass production of aircraft propeller blades made by the unique method of processing them out of a single piece of seamless steel tubing will soon be under way for Army bombers in American Propeller Corporation's huge new plant in the Middle West that was dedicated May 20 with high ranking Government and Army officials in attendance.

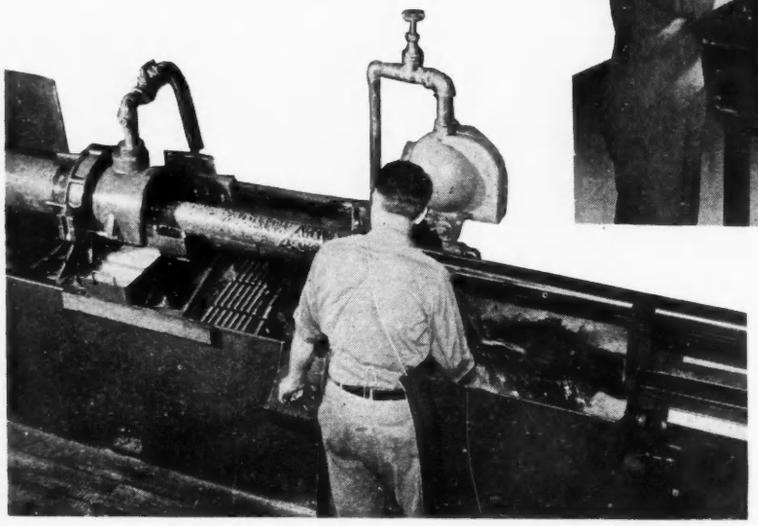
The event marked an important milestone in airplane propeller history since making hollow steel blades out of one-piece of seamless tubing is more adaptable to mass-production methods than other processes and promises to prove better, cheaper and faster. The tubing is transformed into blades by a series of hot forging, cold pressing, machining and welding operations.

The new steel blades are said to be lighter than aluminum in the larger sizes, have a greater resistance to corrosion and abrasion, and the first to be made of a special chromium-molybdenum alloy that is very difficult to work, but gives the blades better physical properties and increased fatigue strength. Research work on the process was started at the

(Right) Quality control—one of the inspection operations on a finished propeller blade.



(Below) Steel tube is honed on the I.D. in a huge W. F. & John Barnes horizontal honing machine fitted with a micromatic hone.



(Right) Here are five stages in the formation of the steel propeller blade from a large diameter tube. From left to right—(a) steel tube, centerless ground on the O.D. on Cincinnati Centerless Grinders and honed on the I.D., (b) tube swaged and upset, (c) and (d) press forming operations, (e) finished and polished blade.

from Seamless Steel Tubing

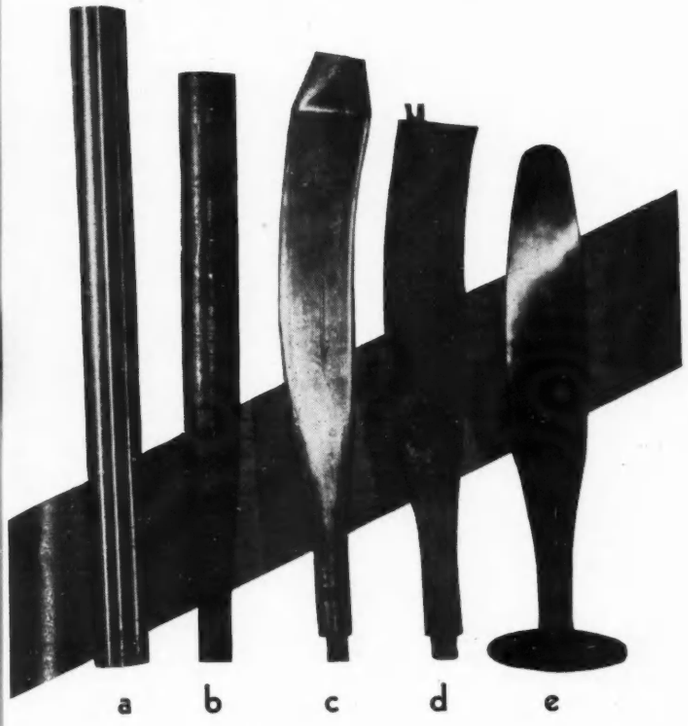
Lycoming Division of the Aviation Corp. in 1935. American Propeller is a wholly owned subsidiary of the Aviation Corp.

One of the largest propeller blade plants in the country, the new unit was financed by the Defense Plant Corp. and designed and built by the Austin Co. The equipment includes four of the largest mechanical presses ever built—giant machines that weigh over 500,000 lb. each.

Pending a more complete technical report on the manufacturing process, these six illustrations give some impression of the nature of the process as well as the character of the equipment now being installed at this new plant.

(Left) Following the swaging operation in the Clearing press, the tube is transferred to this massive Ajax upsetter. Here the swaged end is heated in the Tocco induction heating machine at the left, then upset.

(Below) One of a battery of four Clearing presses with a special horizontal attachment for swaging the ends of the tube. These are said to be the largest presses of this type, weigh well over 500,000 pounds each.



a b c d e

Airbriefs

By HENRY LOWE BROWNBACK

Plywood

Much has been written about plastic airplanes, plywood airplanes, etc., and so much "bunk" has appeared in the newspapers that one might be led to think that something radically new had appeared upon the horizon. Something NEW has but it is the glue, which should be called binder or bonding agent.

At the beginning of the last war a plane was built here in the U.S.A. with a molded plywood fuselage—the L.W.F. One had been built in France since about 1909—the Antoinette, which also had steam cooling, thick wings and direct fuel injection. During the war I saw a one-piece moulded plywood fuselage being built at the Nieuport factory and we built experimental plywood covered wings in the American Army. After the war all of the Fokker planes had all plywood wings, Albert in France built a small all plywood monoplane and Bernard built a large plane with a moulded plywood fuselage and wood covered wings and Couzinet made a big passenger plane all wood which flew the Atlantic. The original Messerschmitt and the Klemm had plywood fuselages. Most of us remember the original Lockheed had a wood fuselage. All of the trouble was with the glue which either was not waterproof or else developed a fungus growth which caused it to deteriorate.

With the modern plywoods a plastic glue or binder is used. It is applied and the wood put under pressure (usually about 200 psi) and heated, which cures the bonder and causes it to penetrate into the wood as well as bonding it into one solid mass. In doing this the glue or bonder is usually a phenolic plastic and comes as a liquid or thin sheets.

Where cold gluing is done, the glue is usually a uremic plastic and is mixed with water, which forms a liquid and causes a normally inert catalyst to become active. In some other types the glue is a liquid or a powder and the catalyst is a liquid which is added. In the latter case the amount of catalyst added determines the speed of the glue. If lots of it is used the glue will set very quickly, but must be used soon after mixing. If little is used the glue can be used over a longer period of time, but will take longer to set. Diligence is necessary in using both types and the uremic type continues to change for about a week when it becomes absolutely waterproof. I have been working with both types lately and can vouch for their performance when properly used. In fact I think that the perfection of plywood and its use will be one of the achievements of the war.

Production

Rolls-Royce have given out some interesting production figures on the Merlin showing that it takes but one-fifth of the time to produce the present job as it did the original machines.

Jet Propulsion

While jet propulsion is not yet in a position to replace the engine and propeller, it is a distinct advance in the art and various jet aids to take-offs are becoming more and more prominent in the technical news.

Rubber

Criticism of any of the Government's policies is outside of the scope of Airbriefs, but at times it seems that outsiders can often see some things which those on the inside miss because they are so close to them. Probably the biggest national tragedy which this war has entailed is the complete loss of our rubber supply which not only threatens our mode of living but is disrupting what the WPB, the OPA and the rest of the agencies in Washington have left of the automobile business.

It would therefore seem the part of wisdom to use every effort to substitute something else for rubber wherever possible and keep all possible rubber for tires. Instead of this rubber experts in every department of the Government seem to be trying to discover ways of using more rubber in the war effort. I will cite two examples—collapsible boats and barrage balloons.

Where collapsible boats must be carried on planes and inflated in the water in case of accident, rubber tubular boats seem to be the cure. But for small boats to be carried with the Army, it seems that some of the folding boats made of treated canvas that have been serving sportsmen for years could be used as they pack as closely and weigh as little as the rubber and can be set up almost as quickly as the rubber boat can be inflated. True, they can be upset, but it is just as true that a few bullets properly placed in an inflated boat will do it no particular good.

Another example is the barrage balloon. Long before rubber impregnated fabric balloons were even thought of, man soared aloft in balloons made of fabrics treated with different varnishes and there is no reason why he cannot do so today. In fact the Civil War balloons built by Professor T. S. C. Lowe and impregnated with a special varnish of his invention had less gas seepage and contamination than present-day rubber balloons. I cite but two cases, but thousands of similar cases exits where some material, even though it may be critical, can be substituted for rubber and the critical material can be made here and rubber cannot. It is useless to point out to the American people that the Germans use but 20 per cent of the rubber per capita that we do or that the British cannot drive passenger cars. Neither Germany nor Britain has been laid out over a pattern of motor car transportation.

Bombers

Some people disagree with me that the big bomber is on the wane just as some people look at majestic battleships and at subs and shake their heads. The facts are plain. The big bomber has several advantages over the smaller machines and these keep them alive as a type. The present shortage of transportation makes it imperative to fly many machines over the ocean and here the big plane excels. It also excels when long distance missions become the order of the day. However, the perfection of interceptor tactics and anti-aircraft guns force the big bombers into high altitudes which make it difficult to hit even a fairly large target and impossible to do any very accurate bombing while the dive bomber is deadly accurate and many of the smaller bombers fly so low that they are hard to hit and can bomb accurately. The effectiveness of any type depends upon the mode of warfare which will be used and whether we can knock the enemy out with long distance bombing attacks or whether we must come to grips with him. In the latter case all types of machines will have to be flown from the Continental flying fields and many of our present attack and pursuit planes will have about all they can do getting in and out of the wrecked flying fields.

Ice

A highly original proposition for the control of wing icing has been made, consisting of an indicator which is operated by the ice as it forms and when it attains a given thickness turns on the de-icers. One of the large rubber companies is making a de-icing boot for propellers, consisting of a boot covering the root of the blade and the leading edge. This boot is grooved in such a manner that the de-icing fluid is led in a pre-determined pattern.

Common-Sense Conservation in Welding Practices

MANY an old timer has his stock of stories about the waste of man power, materials, and equipment in World War I. Unfortunately, many of the "stories" are based on facts. And now again the gossip and the keen-minded observer are turning out their distinctive brands of tales. True or false, the indictments demand some thought. With respect to the waste of oxygen, little has been said, but increased production rates, the employment of green labor, and genuine carelessness engender wholesale waste of this vital industrial gas. Conservation is in order.

Excessive pressures hasten the appearance of leaks in the hose, and checking every bit of equipment should be regular and proper pressures must be maintained.

Truely enough, new welders and cutters must be trained. To give the proper training before and after the worker has been assigned to his job, thousands of cubic feet of this all-essential gas are wasted. Frequently, in an effort to increase production, a worker resorts to the use of higher pressures and other no less wasteful practices. And then, amid shouts for more and more conservation, the careless worker allows a gas which he can neither smell nor see to float away. Surely, there's plenty of oxygen; but the only useful oxygen is on the inside of the cylinder.

A recent survey by a large producer of industrial gases revealed that many shop practices indulged in unconsciously are wasting as much as 25 per cent of the total consumption. The problem of oxygen conservation becomes all the more over-whelming when one thinks of the savings which could be effected in transportation and production costs alone only if more attention were given to this vital issue.

The following points merit careful consideration. In the first place, tip size is of great importance. A No. 2 tip used in place of a No. 1 in cutting ½-in. plate consumes between 10 and 20 per cent more oxygen. Furthermore, even the right tip for the job cannot do efficient work if it is dirty. Constant attention to tip cleaning will do much toward increasing efficiency.

Some workers are inclined to set a cylinder aside when the pressure drops below a certain level, but only a few minutes time is sufficient to make readjustments so that a greater portion of the gas in the cylinder can be used. And, of course, since damaged cylinders must be taken out of circulation to be repaired, all users should pay particular attention to the handling of gas-containers.

Considering the present urgency, it is imperative that users adopt systems of supply which will enable them to keep inventories as low as possible. An often overlooked evil is the reluctance of many promptly to return empty cylinders. Gas suppliers are contributing their share by providing more frequent deliveries. In a sense, this system seems to be wasteful of essential transportation facilities, but the savings in the number of needed cylinders is probably enough to offset the increased shipping costs.

When one considers that a hole 1/64-in. in diameter in a hose carrying gas at a pressure of 100 psi will waste 290 cu. ft. of oxygen (more than a tankful) every 24 hr., the advisability of checking for leaks in every bit of equipment is quite apparent. Immersion in a tank of water will serve to show up leaks in a hose; and soap and water applied to valves and connections is an aid to finding leaks at these points. Since excessive pressures hasten the appearance of leaks in

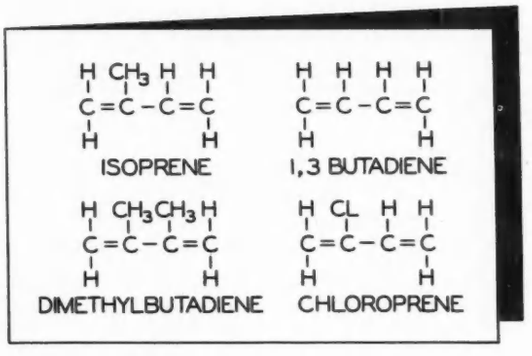
(*Turn to page* 54, *please*)

Many shop practices are wasting as much as 25 per cent of their gas consumption.

Rubber Substitutes

and plans f

THE CONQUEST of the rubber-producing countries of the Far East by the Japanese has suddenly confronted the United States with a very serious problem, as these countries were practically the sole source of our rubber supply. Motor transportation plays a greater part in American life than in the life of any other country, and the sudden cessation of imports of crude rubber will be severely felt. There is, of course, a certain reserve or stock pile, but the requirements for military purposes alone are enormous, and all estimates this writer has seen, of future production from all available sources of both natural rubber and rubber substitutes suitable for use in tires, indicate that no rubber will be available for civilian use for years to come. Under these circumstances it is only natural that all possible alternate sources of natural rubber and all available rubber substitutes should be investigated, and that the production of all promising sources should be pushed to the limit.



Molecular diagrams of organic compounds from which rubber substitutes are produced.

That rubberlike substances can be produced synthetically has been known since World War I, when the Germans, cut off from communication with rubber-growing countries, produced about 2500 tons. However, the product was poor in quality and the cost high, and when natural rubber again became available throughout the world, research devoted to rubber synthesis was largely discontinued. It was resumed, however, during the twenties, and it was then found that some of these rubberlike substances produced synthetically have desirable properties which natural rubber lacks. The most important of these properties is resistance to attack by petroleum derivatives, which made the synthetic product suitable for many purposes for which natural rubber could not be used. There are now about half a dozen of such synthetic products on the American market. The fact that they possess physical properties not found in natural rubber indicates that they are not exact chemical equivalents of natural rubber. In fact, all of the commercial synthetic products have a chemical composition differing from that of natural rubber, and scientists therefore object to the use of the terms synthetic rubber and artificial rubber. The terms "rubberlike substances" and "lastics" have been proposed as more appropriate.

It has been known for more than a century that natural rubber is a hydrocarbon; that is, a compound consisting of hydrogen and carbon, and the proportion of carbon to hydrogen in rubber was first determined by Faraday, the discoverer of the phenomenon of electro-magnetic induction. When subjected to dry distillation, rubber yields a volatile liquid known as isoprene (C_5H_8), with a boiling point of 93 F. Rubber, like other organic solids, is made up of giant molecules with molecular weights running into the thousands. Isoprene has a molecular weight of only 68, and the rubber molecule is made up of a large number of isoprene molecules or of units corresponding to the isoprene molecule. The process of combining a number of similar molecules into a single larger one is known as polymerization, and rubber can be produced from isoprene by polymerization. In fact, if isoprene is allowed to stand for several months at room temperature, the isomerization process sets in spontaneously. It was W. A. Tilden, who in 1882, first called attention to the fact that if isoprene could be produced from some other substance than rubber, the latter could be synthesized or produced artificially.

Unfortunately, to this day it has been found impossible to produce isoprene chemically in large quantities at low cost. Most of the present day rubber-like substances are polymerization products of compounds which are similar in their chemical structure to isoprene. One of these compounds is butadiene (C_4H_6), which enters into the production of buna rubber; another is chloroprene ($C1\ C_4H_5$) which is polymerized into neoprene, and a third is isobutene (C_4H_8), from which Vistanex is produced. Still another hydrocarbon which has been used in the past as the base or mother substance of a rubberlike material in dimethylbutadiene (C_6H_{10}). The similarity of chemical structure of these various compounds can be seen from their molecular diagrams, which are given herewith. It will be seen that in each case there is a straight chain of four carbon atoms in the molecule, and that the carbon atom at each end of the chain is linked to the adjacent one by two bonds. In the process of polymerization, one

By P. M. Heldt

for their large-scale production

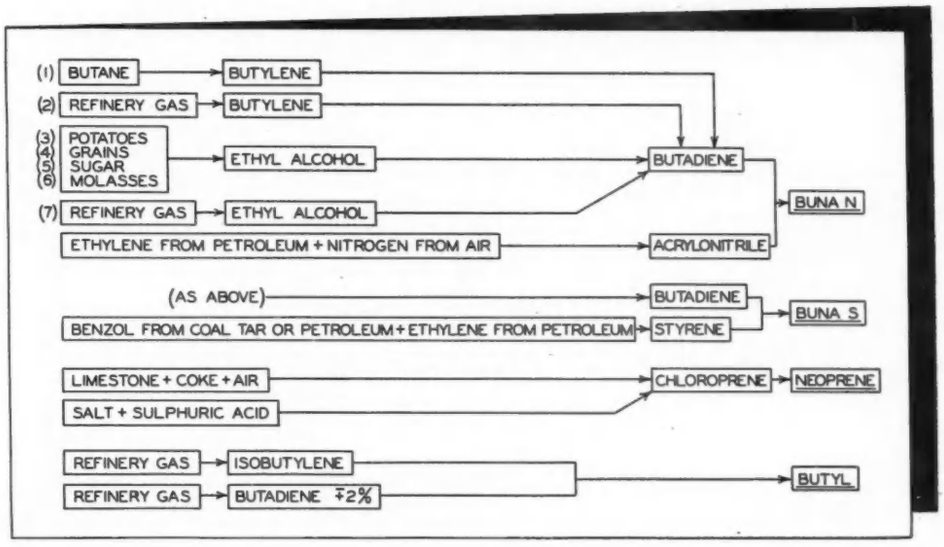
of these two bonds between adjacent atoms swings outward, as it were, and joins the molecule or unit to another, similar one. In this way giant molecules containing up to one hundred, and even more, of the molecules of the mother substance are formed. Chemists refer to this mother substance of a product of polymerization as a monomer.

During the early years of the automobile industry practically all of the rubber used in the manufacture of pneumatic tires came from Brazil, where rubber trees grow wild, and the name "Para" then was the hallmark of quality in the rubber market. Production of automobiles practically doubled year after year, and the rubber production of Brazil could not keep pace with it. The result was a rapid rise in the price of crude rubber, and in 1908 an all-time high price of $3.08 per pound was reached in the New York market. This high price of crude rubber was reflected in high tire prices, and the automobile industry then faced a critical situation, as excessively high tire prices meant a restricted market for automobiles. A man familiar with the economics of truck transportation made the statement at the time that the motor truck would never be a commercial success as long as it depended on rubber tires. Rubber growing in the British and Dutch colonies of the Far East was then taken up on a large scale, and at the same time a new impetus was given to research relating to the chemical constitution of natural rubber and to the synthesis of rubberlike materials.

As already mentioned, most of the present-day rubberlike materials are products of the polymerization of simple hydrocarbons or similar compounds. The production of these materials therefore naturally divides into two phases, viz., the production of the monomer or mother substance from readily available raw materials, and the isomerization of the monomer. During the early period of development most attention was given to the production of the mother substance, while more recently the emphasis has been on improvement of the polymerization processes. Some of the earlier monomers, used during World War I, were obtained from turpentine, but it was apparent from the beginning that this could not be used on a large scale, because of the limited supply and the high cost. Other raw materials investigated included calcium carbide, starch, petroleum distillates, and hydrocarbon gases. One of the large chemical firms in Germany worked out a complete process for making isoprene from p-cresol, a coal-tar distillate, while another produced butadiene from benzene and phenol, other coal-tar products. By still another process, dimethylbutadiene was obtained from acetone by reduction of the latter with an aluminum amalgam and then eliminating the water. The acetone required was produced by the fermentation of potatoes. A special ferment was used and the process yielded one-third acetone and two-thirds alcohol. But during the latter part of the war potatoes were needed for food and therefore were not available for rubber production on a large scale.

Two different methods of polymerizing dimethylbutadiene were employed by the Germans during the World War. By one method the liquid was allowed to stand at room temperature in steel drums about one-third full, for three to four months. This process yielded a hard rubberlike substance which was used chiefly for storage battery cells. By the second method the dimethylbutadiene was subjected to a temperature of 160 F., and the product was a soft rubberlike substance which was used for high-pressure packings,

Simplified Chart Showing Preparation of Vulcanizable Synthetic Rubbers

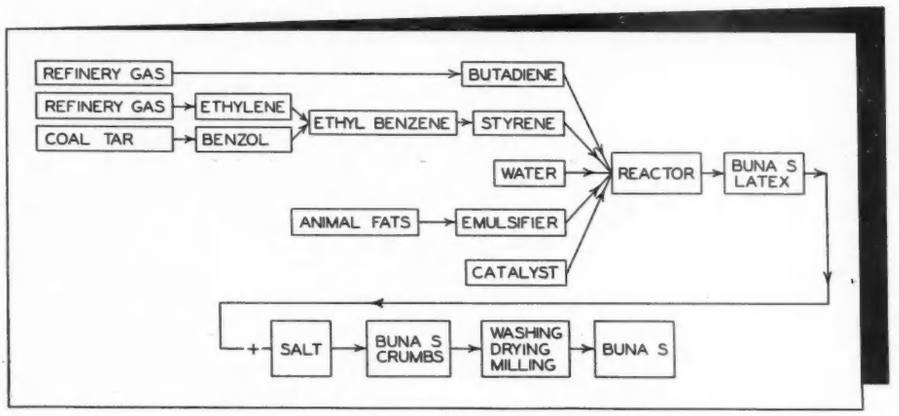


balloon fabrics, and cable insulation. Only the soft rubber was soluble in the usual rubber solvents. Both were greatly inferior to natural rubber in their physical properties, and after the war this line of development was dropped.

In England efforts to synthesize rubberlike substances were begun in 1909, about the time when the price of natural rubber reached its peak, and continued until 1915. Amyl alcohol obtained from fusel oil was used as the base for the monomer. Fusel oil is a byproduct of the fermentation process and consists chiefly of the higher members of the alcohol group. While ordinarily of little value, the supply is strictly limited, and it was quite apparent that fusel oil could not be depended upon as a source of rubber substitutes in large-scale production. An arrangement was therefore entered into with the Institute Pasteur regarding the development of a cheap process for the manufacture of the higher alcohols. This led to the invention of a process for manufacturing such alcohols from starch by fermentation. The process was invented by Fernbach and later developed in England under the supervision of Weizmann. It attained great industrial importance, for alcohol produced by it was largely used during the war as a solvent for dopes for aircraft fabrics, and later, particularly in the United States, as a solvent for cellulose lacquers.

In the British process for the synthesis of rubberlike material, the amyl alcohol in an alcoholic solution was treated with hydrogen chloride, and the new chlorides obtained by fractionation were converted into a mixture of dichloropentanes. This mixture was passed over soda-lime at 880 F. and then gave a yield of 40 per cent isoprene. But this, as well as all other methods of making isoprene synthetically, proved impractical industrially, and the work was discontinued during the early part of the war.

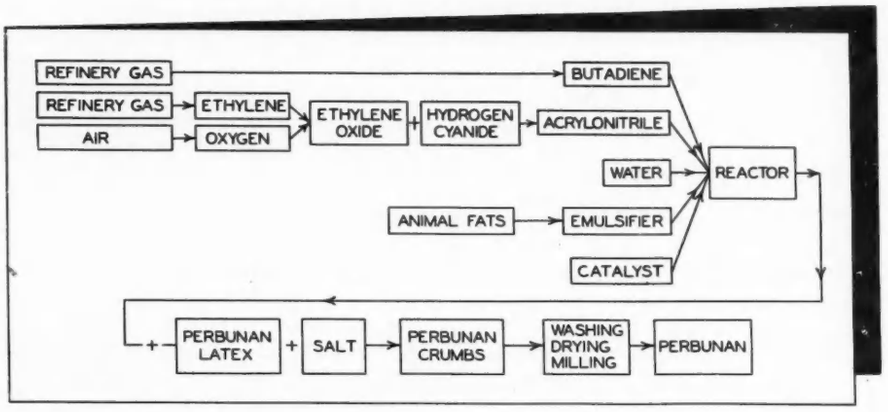
Preparation of Buna S



As a result of large-scale rubber planting in Malaya and the Dutch East Indies, the price of rubber gradually decreased, and in 1922 it reached an all-time low of 14 cents per pound in New York. This took all incentive out of synthetic rubber development for the time being, and practically nothing was done in that line during the next several years. Then, however, steps were taken to "valorize" rubber by restricting the quantities marketed (Stevenson Act). This caused some of the leading industrial nations to realize their dependence on rubber sources under foreign control, and interest in the subject of synthetic rubber was revived. Beginning in 1926, the German I. G. Farbenindustrie took out numerous patents on the preparation of monomers from natural gas containing methane, ethane and ethylene, from gases obtained by the destructive distillation of coal tars and mineral oils, and from gas from cracking stills. From these various gases acetylene is produced by means of an alternating-current arc, and by treatment with dilute sulfuric acid and a mercuric salt, the acetylene is converted to acetaldehyde. The end product, so far as this process is concerned, is isoprene, and it is obtained in eight steps, as follows: Hydrocarbon gas, acetylene, acetaldehyde, aldol, butylene glycol, methyl-ethyl ketone, methyl-ketone butanol, methyl-butylene glycol, isoprene.

In the United States the du Pont Company in 1931 came out with its rubberlike product neoprene, which is a polymerized 2-chloro-1, 3-butadiene. Owing to its structural resemblance to isoprene, the latter product is now usually called chloroprene. Chloroprene is produced from acetylene in two steps. When acetylene is treated with cuprous and ammonium chloride it yields vinyl acetylene (CH_2:CHC:CH). By the addition of one molecule of hydrogen chlo-

Preparation of Perbunan



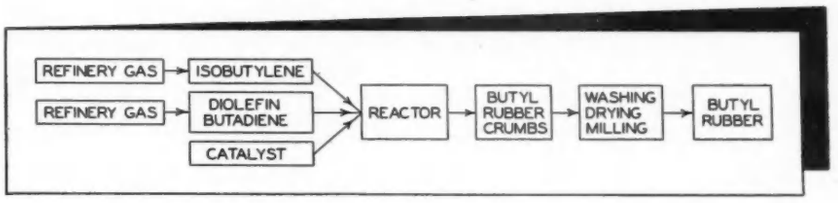
ride to the vinyl acetylene molecule, chloroprene is obtained.

The I. G. Farbenindustrie in Germany continued its researches and developed buna rubber in a number of grades, as well as perbunan. In the course of this development work it was found that a better grade of rubber—one more resistant to abrasion—can be produced if instead of a simple diene, such as butadiene, a mixture of the latter with another compound containing an active vinyl group is polymerized. Such a compound is styrene, C_8H_8, which is produced by dehydrogenizing ethyl benzene, C_8H_{10}, which in turn is produced by combining benzene, C_6H_6, a coal-tar distillate, with ethylene, C_2H_4, a gas obtained from the distillation of coal tar or the cracking of petroleum. Styrene is produced from its raw materials by simple processes, and no difficulties in large-scale production need be anticipated. When a mixture of butadiene and styrene is polymerized, units corresponding to molecules of each of these compounds are said to combine in the same long-chain molecule of the "co-polymer." The buna rubbers now are being manufactured in this country, the American patents being controlled by the Standard Oil Company of New Jersey. Rubbers produced by the buna processes are being marketed by the B. F. Goodrich Company under its own trade name of Ameripol.

In formulating its program for the production of rubber substitutes, the Government picked three of the available products as most suitable for large-scale production, viz., buna, neoprene and butyl rubber. In the original program a production rate of 800,000 tons per year, to be reached by the end of 1943, was provided for, of which 700,000 tons was allocated to buna, 40,000 tons to neoprene, and 60,000 tons to butyl. The latter is a new product developed by Standard Oil Development Co., and is a co-polymer of isobutylene and butadiene, both of which are derived from refinery gases. Butyl has the advantage that it can be produced at low cost by a simple process, but its essential characteristics have not been fully determined as yet. Recently the alcohol and farm interests have come forward and urged the production of synthetic rubber from ethyl alcohol, which process is claimed to be cheaper and to call for less use of scarce materials in the erection of new plants, and as a result the production program has been expanded and production now is expected to reach a rate of one million tons annually by the end of 1943. This would indicate that a quota of 200,000 tons has been allocated to the alcohol plants.

Steps in production of the various synthetic products figuring in the Government program are illustrated by one of the accompanying charts, while the preparation of the various products is shown in more detail in other charts. From the chart for butyl rubber the simplicity of its production process is apparent.

Preparation of Butyl Rubber



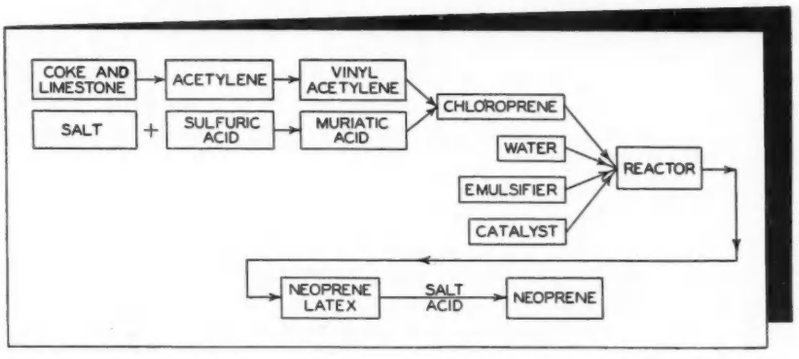
The product slated for largest production, buna S, which is most suitable for tire treads, is a co-polymer of butadiene and styrene, butadine being used in the largest proportion. The simplified chart shows that butadiene can be obtained from either butylene or from ethyl alcohol. The former is a product of refinery gas, while ethyl alcohol is normally obtained from potatoes, grains, sugar or molasses, by fermentation and distillation, but it also can be obtained from refinery gases.

Production of a rubber substitute from ethyl alcohol seems to have reached a practical state first in Russia, where between 10,000 and 12,000 tons are said to have been produced in 1934, and about twice that amount the following year. It seems that in this process the ethyl alcohol is broken up, with the aid of catalysts, into butadiene, water and hydrogen, according to the following equation

$$2\ C_2H_5OH = C_4H_6 + 2\ H_2O + H_2$$

Alcohol = Butadiene + Water + Hydrogen.

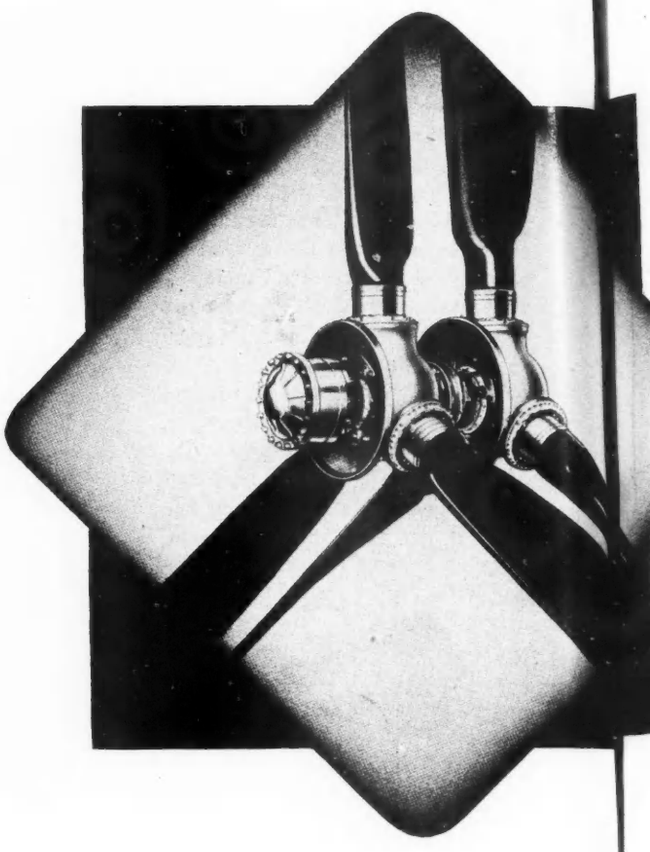
Preparation of Neoprene



The butadiene is polymerized into a rubberlike substance in the same way as that obtained from other materials.

At the present time there are at least three processes available in this country for the conversion of ethyl alcohol into butadiene. One due to a Polish chemist, Stanislaws Szuckewicz, is controlled by the Publicker Commercial Alcohol Company of Philadelphia, and we understand this company is now

(*Turn to page* 70 *please*)



Rotol Contra-

To cope with various problems arising from the constant increase in the power of engines, in aircraft speeds and in operational heights, the contra-rotating (counter-rotating) propeller has been developed in England to a stage justifying its being standardized and produced by several companies, which employ the same underlying principle, but with differences in the methods of applying the principle to practice.

Prominent among the companies producing this type of propeller is Rotol Airscrews, Ltd., a company of which the board of directors includes representatives of two prominent aircraft engine manufacturers, A. F. Sidgreaves of the Rolls-Royce Co. and Sir A. H. R. Fedden of the Bristol Aeroplane Co. Rotol claims to have been the first to evolve the feathering constant speed, contra-rotating propeller, a sectional view of which is reproduced here.

In regard to the contra-rotating propeller in general, it may be recalled that, besides overcoming the difficulty of efficiently converting into thrust the torque of engines of high power, it affords important incidental advantages. Thus, it eliminates automatically the effect of torque reaction upon the aircraft and neutralizes "swing" at both take-off and upon sudden opening or closing of the throttle in flight, so effecting marked improvement in maneuverability in general. Moreover, coping with the need for increasing the number of blades to absorb increased power, it enables six or even eight blades to be utilized, and avoids an increase in propeller diameter and the accompanying drawbacks of increase in blade tip speeds and undercarriage height.

Normally, with increase of aircraft speed and a conventional propeller, the loss of efficiency due to axial-induced losses decreases, while that due to rotational-induced losses increases. In other words, swirl in the slip-stream becomes a much more important factor than the loss due to increase of axial flow as aircraft speeds exceed 400 m.p.h. A propeller with all its blades moving in the same direction imparts a large rotational component to the slip-stream, but the contra-rotating propeller completely eliminates the loss due to this component and gives a steadier flow of air over the fuselage and tends to effect improvement in engine cooling.

As regards torque reaction during take-off and in flight, it is well known that, with the conventional type of propeller, one result is a tendency of the aircraft to fly with one wing lower than the other. This can be counteracted by twisting one wing, aerodynamically, so that it has greater lift than the other, but this expedient has the drawback of increasing the induced drag. With a contra-rotating propeller there are no such effects of torque reaction to be offset. Nor is there the need when the throttle is opened, as in the case of a single rotation propeller, to counteract sudden "swing" by the application of the "opposite rudder," eased off as the forward speed increases. This simplification of control is obviously of advantage under all conditions, but particularly so when an aircraft must take off from a restricted space, such as the flight deck of an aircraft carrier.

So much, then, for the benefits of the contra-rotating propeller in general, benefits that are not merely theoretical, but have been demonstrated again and again in practice. Turning now to details of the Rotol constant speed version, this has a pair of oppositely rotating three-blade units with their pitch-changing hydraulically operated mechanism interconnected. The front unit acts as a left-hand tractor and the rear as a right-hand, with their centers 15 in. apart.

Naturally, the weight of the contra-rotating propeller as a whole exceeds that of a comparable three-blade propeller, but it is held that the benefits of the design more than compensate for the additional weight, which is approximately 20 per cent.

Accommodating either wood or metal blades, the former securing exceptional take-off thrust and the latter being particularly suitable for high speed conditions, each hub is formed of two steel pressings welded together at the center line, and has three internally threaded sockets in which the blade assem-

blies are directly mounted. The hubs are machined inside and out, and are mounted on separate, internally splined, centers by a ring of fixing bolts at each end. The centers are arranged to fit on splined shafts built to the Society of British Aircraft Constructors standard, with appropriate cones and a steady bearing on the inner shaft in front of the rear hub.

In the front walls of each hub and in the rear face of the front hub are three holes to accommodate guides for the operating links that connect the blade roots to the single hydraulic cylinder, by which variations in pitch are effected. As seen in the drawing, the operating cylinder is located forward of the front propeller unit, with the operating links running back through the front hub to a link thrust bearing and thence into the rear propeller hub.

To the front face of each hub a spinner support is secured; it is a dished circular plate bored to be located on the front guides of each hub. The back plates of the spinner are attached to the rear flange of the hub-driving center.

Two pressure oiltubes, mounted concentrically run through the inner propeller shaft to the hydraulic cylinder, which itself is moved to vary the pitch, the piston having no axial movement. The cylinder, of aluminum alloy, is fitted to a hollow steel stem that slides in the shaft of the forward propeller and is located rotationally relative to the front hub by the three guides of the operating links. The stroke of the cylinder is limited by (1) a coarse-pitch stop integral with the piston and making contact with the inner end of the cylinder in the coarse pitch or feathered position and (2) a fine-pitch stop that makes contact with the front hub center when the propeller is in fine pitch. Between these two extremes the cylinder moves freely in response to oil pressure generated in the governor, a separate unit.

Irrespective of whether the blades are of wood or metal, their roots are encased in steel adaptors, and, to facilitate axial rotation for pitch-changing, the adaptors are mounted in the hubs in two-row ball bearings designed to

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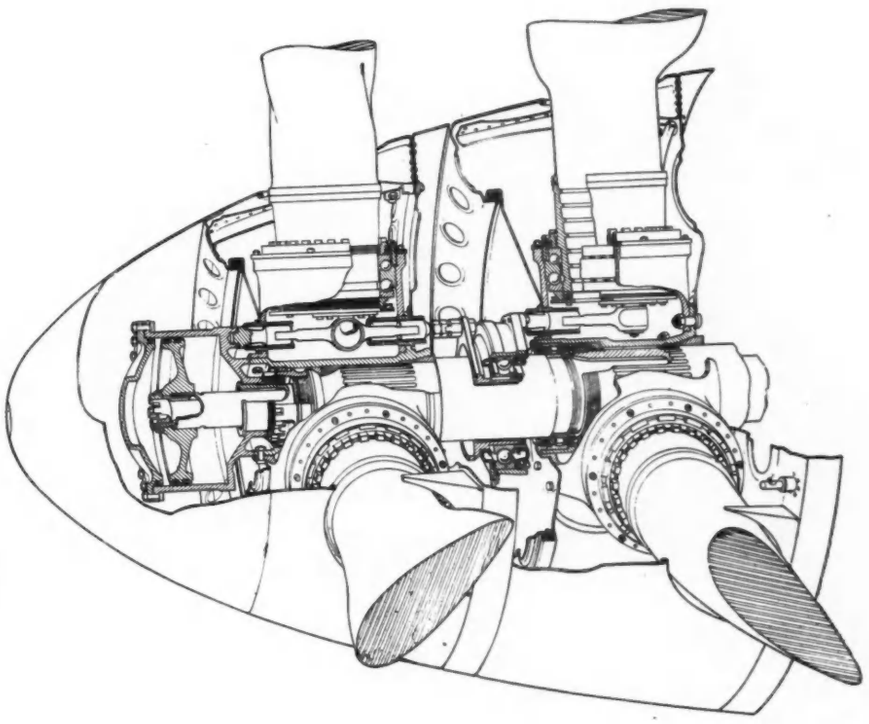
Rotating Propeller

By
M. W. Bourdon
Special Correspondent of
AUTOMOTIVE *and* AVIATION
INDUSTRIES in Great Britain



Cutaway perspective of the Rotol contra-rotating propeller showing the operating details.

New Airplanes of

The Red

INFORMATION concerning Russian planes, strangely enough, frequently comes from German sources. The new types shown on these pages are presumably in use during the present campaigns. Some follow the general lines of American fighter craft; others appear to be copies of British and German types. Concentrating largely on the development of close support types, the Russians have amassed a variety of planes which appear to be the equal of any in the world.

Two fighters, the I-26 and the MIG-3, are now in service. The I-26, somewhat similar in design to the British Hurricane, is powered by an 1100-hp. M-105 liquid-cooled V-type engine, and is armed with two machine guns and a motor cannon. The MIG-3, apparently the Soviet's latest fighter, is driven by a 1200-hp. AM-35A liquid-cooled engine. It has a top speed of approximately 360 m.p.h., and carries one heavy and two light machine guns. There is reason to believe that its fire power has been increased in the last few months.

The Stormovik dive bomber, known as the IL-2, is fitted with a backward-retracting landing gear and is propelled by a 1300-hp. AM-38 liquid-cooled engine. Developed from the Heinkel He118, the Stormovik mounts two 32-mm. cannon and two machine guns in the wings.

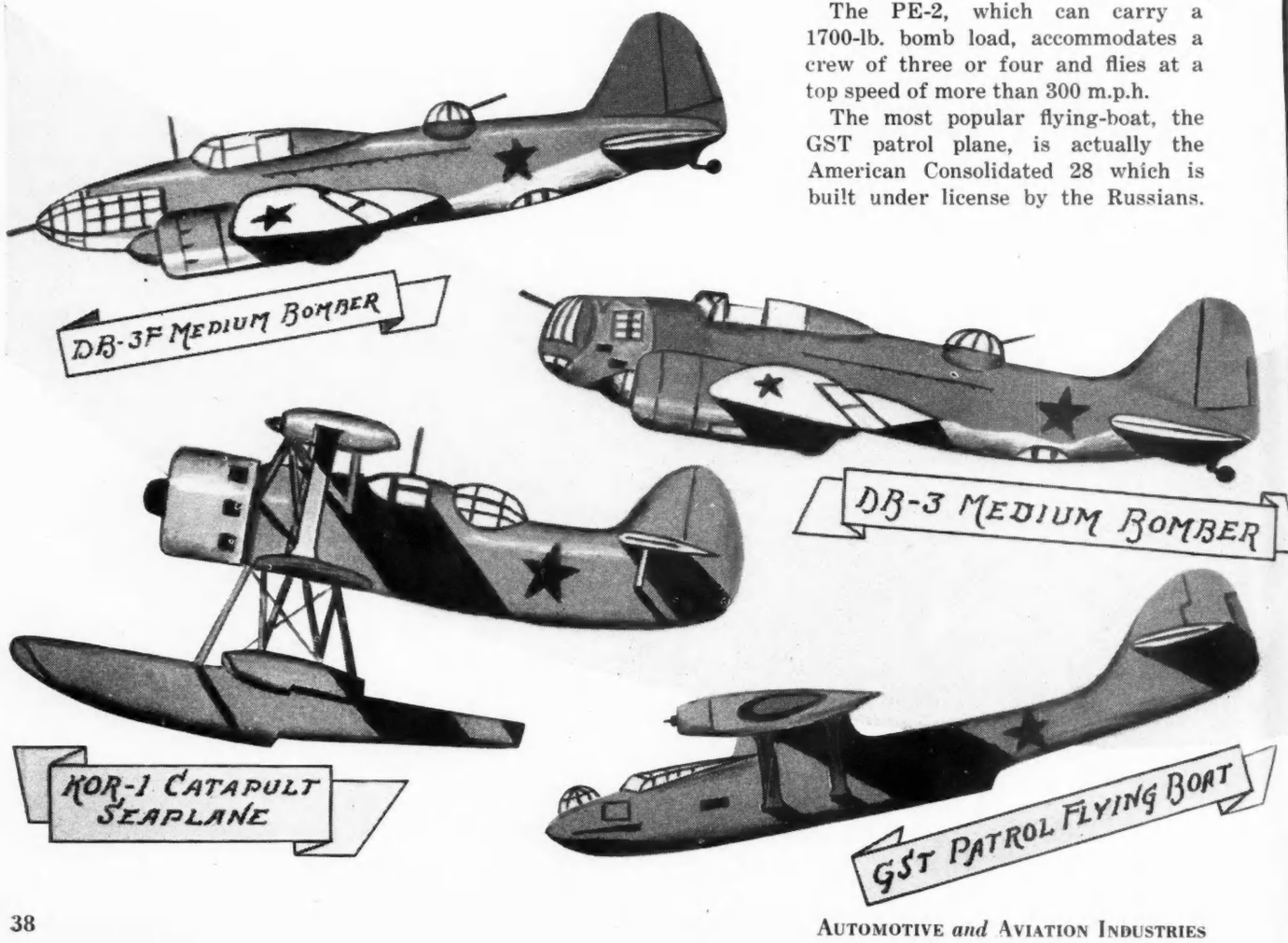
The SU-2, similar in appearance to the Brewster Bermuda, is a two-seat fighter-bomber. Driven by a 1000-hp. M-88 radial, the plane carries two forward machine guns in the wings and one in the rear turret. The plane, it is believed, is also used as a single-seat fighter equipped with four guns in the wings.

Another plane, a modification of the SB-3 and which is labeled the SB-RK, is fitted with Ju 88-type dive brakes under the wings. Both planes are driven by 1100-hp. M-105 liquid-cooled engines.

The two new types of reconnaissance bombers, the YAK-4 and the PE-2 are quite similar in appearance. Each is a twin-motored low-wing monoplane. The YAK-4 carries a crew of two and is powered by two M-105 12-cylinder liquid-cooled 1100-hp. engines. The dive bomber version, called the BB-100, is also employed as an attack-bomber.

The PE-2, which can carry a 1700-lb. bomb load, accommodates a crew of three or four and flies at a top speed of more than 300 m.p.h.

The most popular flying-boat, the GST patrol plane, is actually the American Consolidated 28 which is built under license by the Russians.

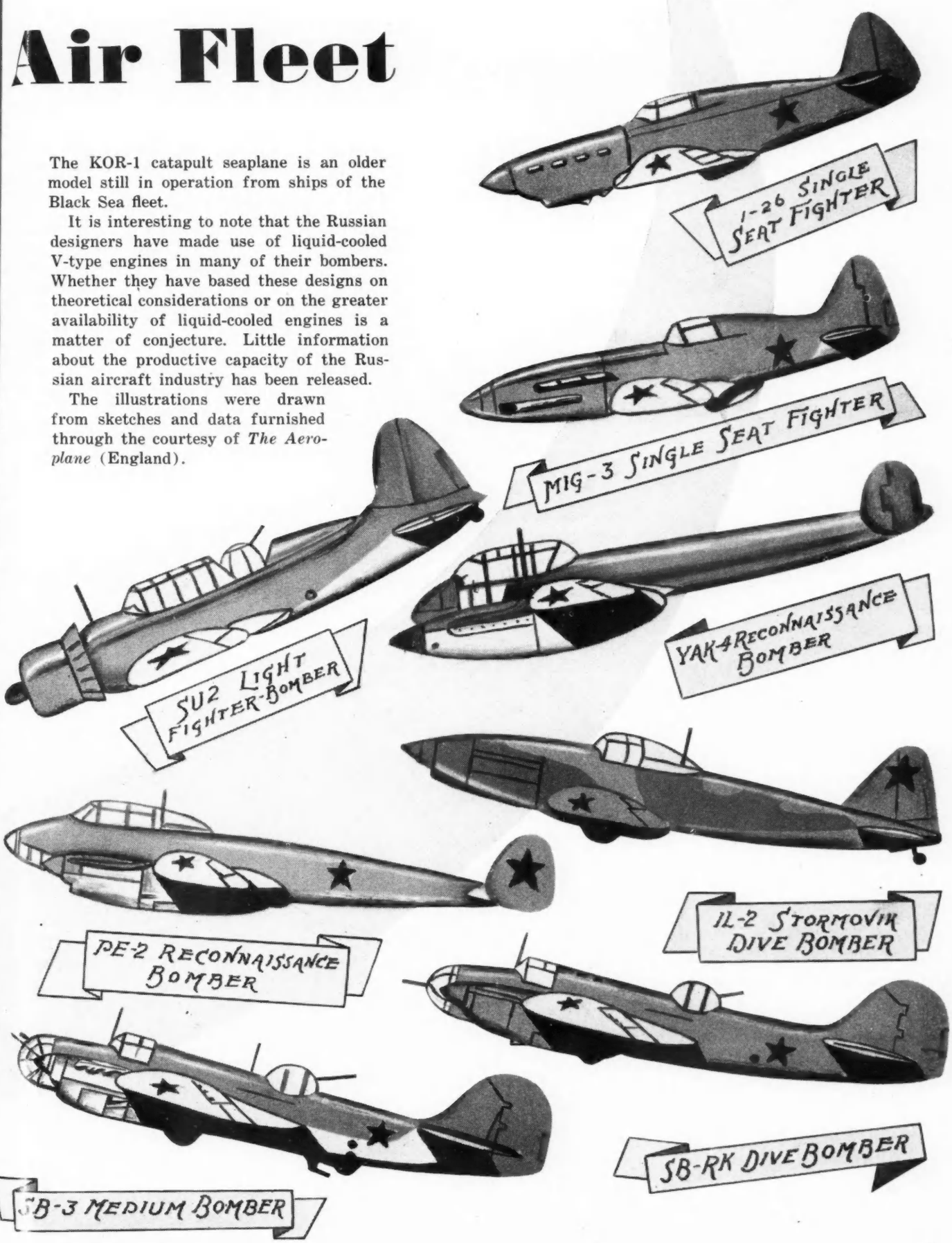


Air Fleet

The KOR-1 catapult seaplane is an older model still in operation from ships of the Black Sea fleet.

It is interesting to note that the Russian designers have made use of liquid-cooled V-type engines in many of their bombers. Whether they have based these designs on theoretical considerations or on the greater availability of liquid-cooled engines is a matter of conjecture. Little information about the productive capacity of the Russian aircraft industry has been released.

The illustrations were drawn from sketches and data furnished through the courtesy of *The Aeroplane* (England).



Stabilization of

Chlorinated Solvents

for Metal Degreasing

A REPORT recently issued by C. F. Dinley, vice-president in charge of engineering, manufacturing and research, Detroit Rex Products Co., describes the theory and practice of the stabilization of chlorinated solvents used in metal cleaning. It is pointed out that in the cleaning or degreasing of metals by the use of hot solvents, the chlorinated solvents are of the safety type. The process itself takes advantage of their high vapor weight, low specific heat, and non-inflammability.

In degreasing with chlorinated solvents, the metal leaves the degreaser entirely free from liquid. The hot dry metal may be stored or processed immediately as there are no stains, and no discoloration, the metal being immediately ready for inspection, painting, and in many cases plating. The degreasing equipment requires a minimum of space, heat, and water. The operation is easy, neat and quick.

When the writer's early laboratory tests on the various chlorinated solvents under consideration for metal cleaning were well along, the rather startling fact was revealed that these solvents had a tendency to split up into other chlorine products, among which was hydrochloric acid. This fact indicated that research was needed to prevent such occurrence, as the metal degreasing process would be of no commercial value until this difficulty was overcome.

The decomposition of the solvent was caused by light, water, heat and some non-ferrous metals, as well as by fatty acids, etc. A search of literature, text books, and other printed matter brought to light that this problem of decomposition had been completely ignored.

Research was immediately started along various lines. Fractions of the commercial chlorinated solvents were brought to closer boiling ranges, but this did not help. Original containers were imported direct from foreign countries, but on the whole these were consistently of poorer quality than the same solvent made in the United States.

After these facts were brought to light, work on the problem of stabilization began in earnest. Additive chemicals, such as those that were easily chlorinated, were first employed, the thought being that under the heat of the degreasing process the easily chlorinated material would prevent the formation of hydrochloric acid. Any objectionable substances formed would be removed in the process of solvent purification, that is, distillation which is a routine procedure in the maintenance of degreasers. This line of endeavor proved of little value.

The final theory of incipiently absorbing any acidic products of decomposition by a substance capable of assimilating the hydrochloric acid radical in its entirety without the end products themselves being harmful, was tried. This proved to be the correct theory for stabilization. Organic chemicals capable of this reaction cover many fields, and experiments were legion. The results of these experiments indicated the necessity in the metal degreasing field of having a stabilizer of the organic base type,** which would be soluble in the chlorinated solvent, would volatize with the solvent vapor during distillation, remain soluble in the vapor and condense with the vapor, thus rendering the condensate stable. This is successfully accomplished by using an organic base whose boiling point and vaporizing rate are such that the reaction of the chlorinated solvent is always basic regardless of the number of times the solvent undergoes distillation.

The degreaser is to all intents and purposes a thermo-balanced, open still, wherein a heating means is placed at the bottom of the vessel. Application of heat allows the vapor to rise to a predetermined height. This vapor height is controlled by placing a cooling means within and attached to the open tank at a definite level below the open top. Thus, we have the vapor rising and the vapor condensing in the open vessel. By means of a trough or gutter, the liquid solvent is collected and the stream can be directed as desired.

Since the degreaser has an open top, the solvent vapor is always in contact with air. This air is constantly in motion and contains moisture which is transferred to the solvent vapors at the interfacial layer. This exchange actually is a source of introduction of moisture which, added to that accumulated from the metal being cleaned in a commercial degreaser, at times may become considerable. Therefore, a water separator is supplied with most degreasers. It is this moisture which saturates the solvent vapor at the time of condensation that makes it necessary that the solvent vapors be slightly basic. At this condensation stage, in contact with metal and under the influence of daylight, the chlorinated solvents are very easily decomposed.

The same theory of stabilization is applicable to all types of chlorinated solvents, and gives considerable freedom in the kind of organic use that may be selected.

**The following U. S. Patent numbers cover the stabilization of chlorinated hydrocarbon solvents, and equipment for their use in industrial cleaning applications: 1,771,698; 1,869,826; 1,869,845; 1,875,937; 1,907,875; 1,911,926; 1,938,841; 1,942,355; 1,961,867; 1,984,364; 1,987,586; 2,016,376; 2,018,648; 2,020,335; 2,028,759; 2,036,261; 2,101,840; 2,101,841; 2,107,369; 2,113,129; 2,116,862; 2,116,863; 2,137,479; 2,214,788; 2,223,595; 2,273,939; RE-20,359.

Rationing and the

Passenger Car Stockpile

By Wm. B. Daub

AFTER three months of auto rationing the public is still somewhat uncertain about the operation of the system set up by OPA, the method by which quotas were determined, and the rate at which cars are being sold. Although the workings of the inner circle may never come to light, an unbiased appraisal of some of the rationing problems may serve to dissipate the bewildering fog.

At the outset of rationing, state quotas were based primarily on new car registrations for 1941. In many counties, however, the extent of local war and defense activity was an important determining factor. In California, for instance, this factor, along with others such as exposure to potential air attack, greater distances, and population distribution, played an important part in determining the state reserve for that state. It must be remembered that "reserves" have been set up for each state and the Federal Government. These allotments have been made in addition to the regular quotas; from the Government reserve the OPA will make up shortages in state quotas; from the state reserves the local rationing boards will be able to draw additional cars if the need arises.

Save for this brief explanation, little information on quota determination has come out of Washington. The table shown below will serve to show the reader how the quotas for the first rationing period (ending May 31) compared with total registrations for the various states and the District of Columbia. It should be noted that rapid shifts in registrations may tend to distort these ratios.

How many passenger cars are actually available for rationing? According to reports made in the early part of January, 650,000 to 700,000 cars were to be on hand by the end of the manufacturing period. But with the completion of a systematic survey by OPA of automobile dealers and manufacturers, the total has fallen to approximately 535,000. Of this total 400,000 are to be rationed this year, and the remainder, 135,000, are to be stored in the Government stockpile. This stockpile, consisting of cars produced after Jan. 15, is not to be disposed of for the time being unless specific permission is given by OPA. A telegram sent to manufacturers in mid-January stated that permission to sell "will be granted by OPA when it is deemed in the public interest, but probably not before January, '43."

What has happened to new car sales? Is the Government really striving to retard sales in spite of its public pronouncements that the dealer must be given a chance to sell his product? Dealers, worn, weary, and perplexed, seem to believe that altercations within the OPA have not worked to their advantage. Many are definitely convinced that the Government is going to handle rationing in its own way, disregarding the pleas of dealers for the relaxation of restrictions. In any case, more clearly to understand the Government's stand, all would do well to reflect on Leon Henderson's statement read by Cyrus McCormick at the national convention of the National Automobile Dealers Association.

Mr. Henderson said in part:

"The rationing plan for automobiles established certain classifications of preferred purchasers whom it is thought are more in need of buying a car than are other people. For example, I will find it extremely

(*Turn to page 72, please*)

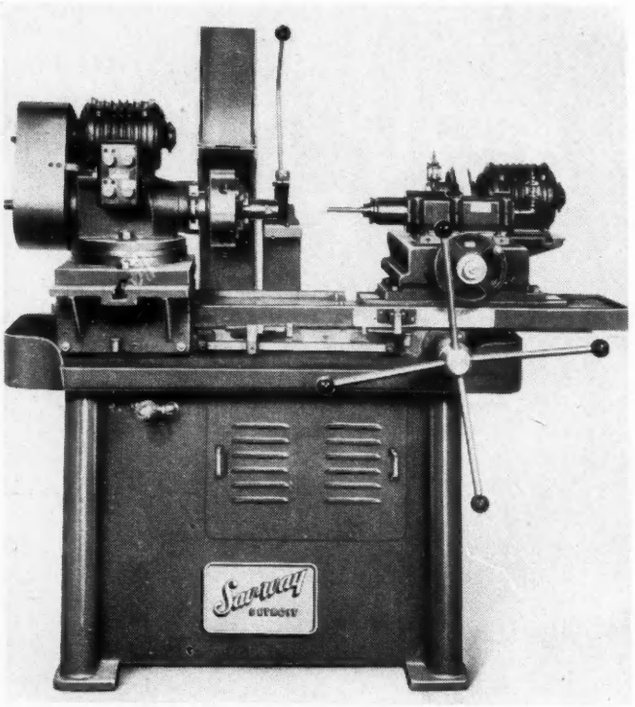
Ratio of Cars Allotted to Cars Registered in the Various States

(Based on Quotas for March, April and May)

	Cars Registered		Cars Registered		Cars Registered
Alabama	1 to 210	Maryland	1 to 235	Pennsylvania	1 to 215
Arizona	1 to 310	Massachusetts	1 to 210	Rhode Island	1 to 240
Arkansas	1 to 300	Michigan	1 to 140	South Carolina	1 to 270
California	1 to 280	Minnesota	1 to 310	South Dakota	1 to 410
Colorado	1 to 335	Mississippi	1 to 230	Tennessee	1 to 235
Connecticut	1 to 220	Missouri	1 to 250	Texas	1 to 260
Delaware	1 to 230	Montana	1 to 260	Utah	1 to 290
District of Columbia	1 to 160	Nebraska	1 to 340	Vermont	1 to 260
Florida	1 to 260	Nevada	1 to 190	Virginia	1 to 200
Georgia	1 to 235	New Hampshire	1 to 260	Washington	1 to 275
Idaho	1 to 270	New Jersey	1 to 230	West Virginia	1 to 235
Illinois	1 to 210	New Mexico	1 to 300	Wisconsin	1 to 275
Indiana	1 to 230	New York	1 to 230	Wyoming	1 to 260
Iowa	1 to 340	North Carolina	1 to 270		
Kansas	1 to 310	North Dakota	1 to 350		
Kentucky	1 to 300	Ohio	1 to 220		
Louisiana	1 to 250	Oklahoma	1 to 330		
Maine	1 to 250	Oregon	1 to 260		

Note: OPA allotments are based on NEW registrations. The lower ratios in several states are probably due to a higher rate of increase in new car registrations in these states.

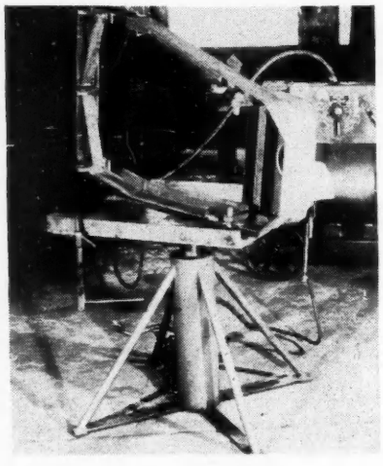
MEN and



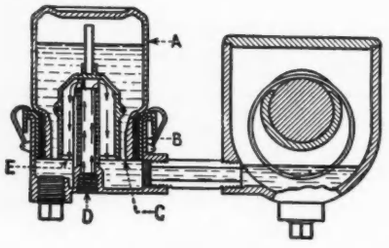
The new Sav-Way internal grinder is fitted with an adjustable headstock which permits an adjustment to a distance of 3¼ in. at right angles to the wheel traverse.

HOLES up to 9 in. deep and ¼ to 18 in. in diameter can be ground on the Sav-Way internal grinder manufactured by the Sav-Way Tool and Machining Co., Detroit, Mich. A new headstock design permits an adjustment to a distance of 3¼ in., at right angles to the wheel traverse. Motors, bearings, coolant pump, electric controls, and grinding spindle are leading standard makes. The ways, tables, and cross slide are cast iron, hand-scraped to 0.0002 in.

A NEW 100-ton forcing press, recently completed by The Watson-Stillman Co., Roselle, N. J., is controlled through a single hand lever. Primarily designed for forcing shafts into rotors, the machine provides an advance speed of 200 inches per minute, a pressing speed varying from 0 to 25 inches per minute, and a return speed of 140 inches per minute. The distance between the horizontal bars is 72 in., the opening is adjustable from 24 to 120 inches, and the ram stroke is 18 inches. The gap in the rear abutment will accommodate shafts up to 6 in. in diameter.

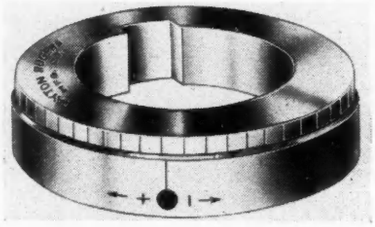


Equipped with a foot-operated hydraulic pump, a new revolving welding table built by the LYON-Raymond Corp., Greene, N. Y., can be adjusted to any height between 26 and 40 in. The standard table is 30 in. square.

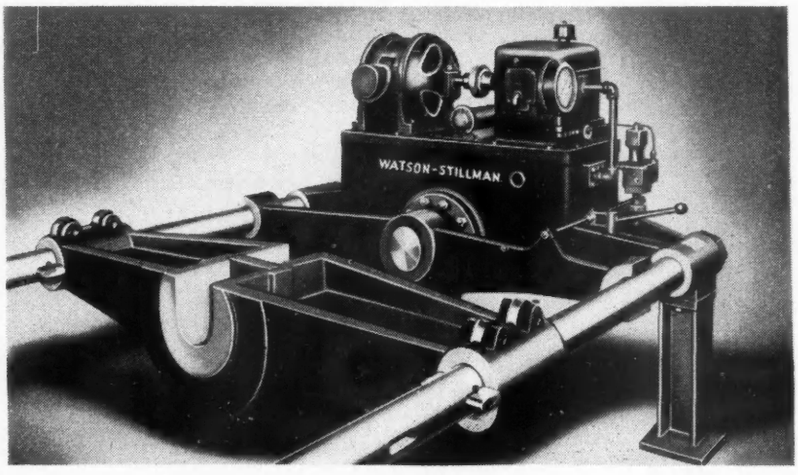


Obtainable in capacities of 2, 4, 8, and 16 oz., this Oil-Rite lubricator, built by the Oil Rite Corp., Milwaukee, Wis., releases automatically just as much oil as is needed to maintain a constant lubricant level. A glass oil reservoir permits instant checking of the oil reservoir.

ENGINEERS and draftsmen are finding in the Vari-Typer engineering composing machine a new means of lettering notes, bills of material, and dimensions on large engineering drawings. The basket-type carriage, open at both ends, will handle sheets as large as eight by twenty feet. The new Vari-Typer is an adaptation of



Made with a direction indicator and an element graduated in thousandths of an inch, this new adjustable spacing collar, manufactured by the Dayton Rogers Mfg. Co., Minneapolis, Minn., eliminates the use of shims in setting cutters on milling machines.



Watson-Stillman 100-ton forcing press.

MACHINES

the standard Vari-Typer which can be adjusted to vary the space between characters and to accommodate various type fonts. The machine is built by the Ralph C. Coxhead Corp., New York, N. Y.

CONTAINED in two conveniently handled cases, a portable wattmeter-type balancing unit, designed by Westinghouse Research Laboratories, has been announced by the Gisholt Machine Co., Madison, Wisc. Built to check both phase angle and amplitude, the machine can be used to analyze vibrations in large parts rotating from 100 to 10,000 rpm. Although the machine is well suited to occasional balancing operations, it is not offered as a substitute for the Gisholt line of production balancing machines.

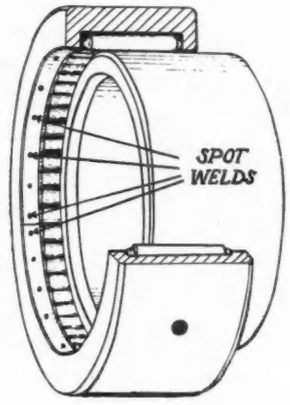
FASHIONED from wood instead of steel, the bench grating of the work compartment prevents sparks from igniting magnesium dust created by grinding, buffing, or polishing operations in the Hydro-Whirl Magnesium Booth manufactured by the Industrial Sheet Metal Works, Detroit, Mich. As an added protection against spark ignition, the booth sections are lined with Masonite. An automatic control maintains the water level at a uniform height in a tank below the grating.

AN IMPROVED method of installing the roller-retaining rings of Bantam quill bearings by spot welding is said to produce a sturdier and more permanent assembly. In service, the entire load is carried to the solid outer race; none of the load, axial or thrust, is against the retaining rings which serve solely to hold the rollers in place. The bearings are manufactured by the Bantam Bearings Corp., South Bend, Ind.

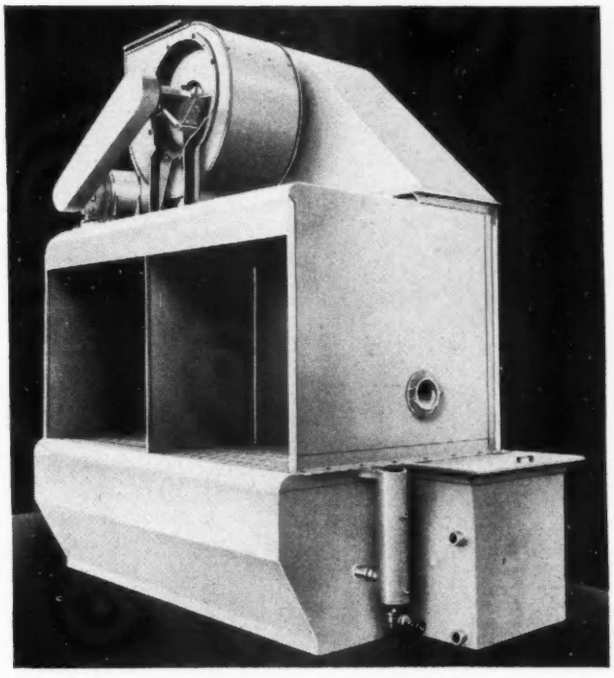
DEVELOPED primarily to reduce labor time and costs associated with forming extruded sections to various shapes, a new-type metal-forming ma-

Offered by Gisholt Machine Co., this portable wattmeter - type balancing machine is recommended for use in determining the location and amount of unbalance in large rotating parts.

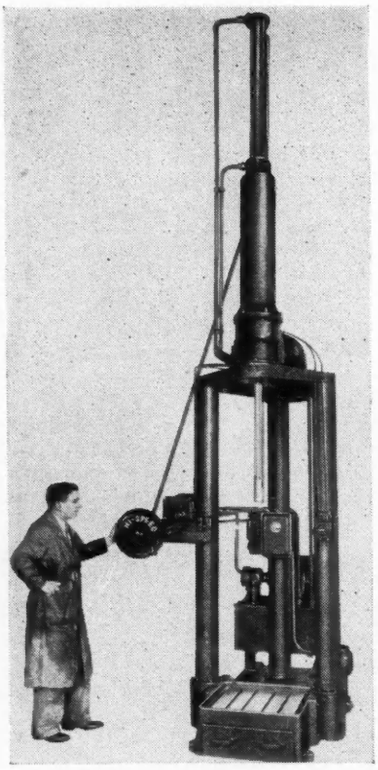
This adaptation of the Vari-Typer, built expressly for the handling of large drawings, incorporates a large basket-type carrier which will accommodate sheets as large as eight by twenty feet.



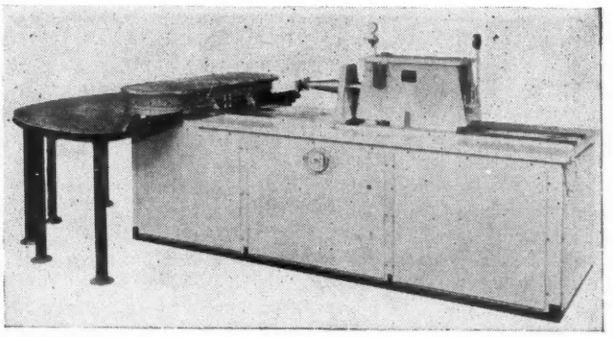
Improved Bantam quill bearing features spot-welded retaining ring.



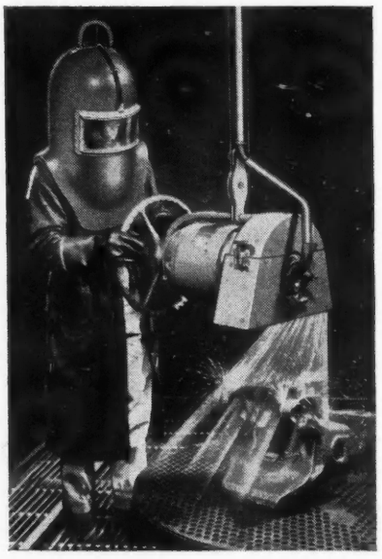
New model Hydro-Whirl magnesium booth.



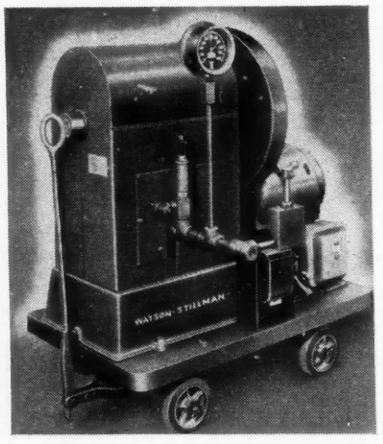
This Hi-Speed honing machine is especially designed to hone cylindrical surfaces up to 24 in. in diameter and 72 in. long.



Metal - forming machine to produce extruded sections of various shapes.



A new portable Wheelabrator, incorporating the airless-abrasive-blast principle, has been announced by the American Foundry Equipment Co., Mishawaka, Ind. Suspended by a spring-balanced cable connected to a carriage running in a radial track the Wheelabrator is fed through a telescopic pipe leading from an overhead abrasive hopper.



Watson - Stillman high - pressure pump for testing all types of high-pressure vessels.

chine is announced by the Southern Engineering Co., Inc., Los Angeles. Already in use by over eight of the leading aircraft manufacturers, the machine is said to be speeding production of parts for airplanes by as much as 45 times over former hand forming methods.

The machine consists of two basic sections: the movable head onto which the dies are bolted, and the air ram to which the mating die is attached. A 5 hp variable-speed reversible transmission system drives the head at an infinite range of speeds between 91 and 275 inches of travel per minute. Using normal air line pressure, up to 2½ tons pressure is exerted by the air ram.

Formation of straight extruded sections into the desired form is accomplished by attaching one end of the straight section to the movable die and then drawing it between the movable die and the die block located on the air ram. The metal is tightly confined to the cavities of the die and any type extrusion can be formed to the desired shape without danger of wrinkling, and with a minimum of internal stresses.

Three types of movable heads are available: a circular one for the forming of parts that have a symmetrical radii or an interrupted radii with no straight sections; a semi-circular head to form parts with straight sections, slow sweeps, curves, and offsets; and a straight head which travels only in a straight line for the forming of wing spar caps, stringers, and all other longitudinal parts that have relatively small sweeps or changes in plane. The first two revolve forward or backward, or through a full 360 degree circle.

A minimum of skill is said to be required in the operation of the machine. Such materials as magnesium, dural, and stainless steel can be formed on the machine, in addition to aluminum alloys. With the use of a mandrel, tubular sections can be formed as easily as conventional extrusions.

INTERNAL cylindrical surfaces with bores up to 24 in., and with any length from 20 in. to 72 in., can be honed accurately, quickly, and economically on the Hi-Speed honing and lapping machine, according to its makers, the Automotive Maintenance Machinery Co., North Chicago, Ill. Centrally-located controls at the front of the machine permit changes in the speed of reciprocation or rotation of the spindle. A positive stop and dwell system makes it possible to stop the spindle at the bottom of each stroke or at any point within the stroke range without any shock to the machine or the work being honed.

Hi-Speed Honing Machines are made in four sizes, any of which can be had with strokes up to 72 in.

A NEW portable test pump, manufactured by The Watson-Stillman Co., Roselle, N. J., employs a three-plunger pump driven by a 3-hp motor. Developing a maximum pressure of 8200 psi at a delivery rate of ½ gpm, the pump is suited to the testing of boilers, tubing, and all kinds of high-pressure vessels. Complete with pressure gage, safety valve, needle valve for pressure regulation, motor, motor starter, disconnect switch, and 25 feet of rubber cable, the unit weighs 1450 lb.

DISPERSIONS of "dag" colloidal graphite in volatile mineral spirits have been added to the standard dispersions available from Acheson Colloids Corp., Port Huron, Mich. Oustanding characteristic of the newly standardized dispersion is said to be its unusual flexibility.

Designated Series type 2400, they

(*Turn to page 78, please*)

ACWP Launches Drive to Gather in the Scrap

Committees in Auto, Truck, and Parts Plants Tackle Job of Scrapping Obsolescent Equipment, Collecting Scrap

Enlisting in the campaign for scrap iron and steel to keep the war production program in high gear, the automotive industry through the Automotive Council for War Production has launched an intensive drive to salvage scrap metals from its plants. Approximately 1000 companies in the automobile, truck, and parts manufacturing industry are involved in the campaign, which was scheduled to get under way in all plants by mid-June.

The War Production Board, which approved the drive, has issued no directives in the matter but has left the problem of what machinery and dies should be scrapped up to the individual companies. Each company will review its stocks of obsolete tools, dies, molds, flasks, machinery, equipment, and buildings and then decide which can be scrapped without impairment of war operations.

After considering the situation, the ACWP decided not to set an arbitrary date or model year as a deadline, with all dies and tools for parts prior to that date to be relegated to the scrap heap. There is a great deal of variance in the requirements for functional replacement parts between companies, due to different engine and chassis types. There also is a divergence between companies on their parts inventory policies. So a uniform scrapping policy on a year or model basis is impractical.

According to the formula worked out by the Salvage and Conservation Committee of the ACWP, if the equipment is designed for production of an essential part, the decision as to its disposal should be based on an honest attempt to weigh the relative importance of its potential values to the nation as scrap and as an existing tool. Where duplicate sets of equipment, such as dies, exist, the extra sets probably will be scrapped if the responsibilities to the car owners can be fulfilled with only one set.

In the case of forging dies, manufacturers will have to decide whether it would be more beneficial to machine off the working face of the die and use the remainder as the basis for a war production die or to scrap the entire die to feed the blast furnaces. Dies for nonfunctional parts, whose manufacture is at present prohibited, also may be added to the scrap pile.

Plant salvage authorities have been urged to scrap all except the most essential equipment, keeping only that which is for current or potential war production, which is required for the maintenance of war transport facilities, or which would provide for speedy post-war employment of U. S. workers who otherwise would be idle for the additional year required to design and obtain new tools, dies and equipment. This would appear to postpone any immediate thought of scrapping 1942 model dies, as had been suggested by a WPB salvage official at a Detroit meeting several months ago. It is likely that only a long drawn-out war and an acute steel shortage would prompt the decision to scrap 1942 dies. The WPB has no immediate intention of asking the automotive industry to scrap useful machines.

The ACWP has asked all automotive companies to designate a specific salvage authority for each company, and have him charged with the responsibility of disposing of all obsolescent equipment in the company's plant. This authority can be either an individual or a committee. Monthly salvage disposal reports will be sent to the ACWP five days after the close of each month.

(*Turn to page* 54, *please*)

SAE, Detroit Society Hold Joint Meeting

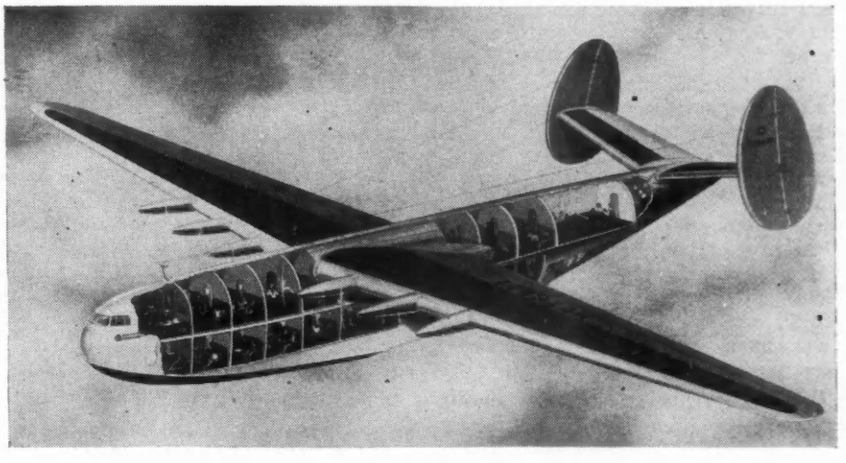
Members of the SAE, Detroit Section, and the Engineering Society of Detroit gathered on June 8 for the first of a series of symposiums designed to supplant the regular Summer Meeting. Highlighting the war production of aircraft, the all-day session was a huge success both in interest and attendance.

Perhaps the most impressive feature of this event was the exhibit of aircraft parts, engines, and striking examples of the latest developments in steel foundry practice and centrifugal steel casting contributed by the Ford organization. In addition, Ford had posters showing the conversion of the Village Industries to war products.

First paper on the program was on the subject of "The Correlation of Ground and Altitude Performance of Oil Systems" by John Dolza, special assignment engineer, Allison Division, G.M.C. Although copies of the paper were made available to those attending the meeting, its reproduction has been prohibited by the AAF.

W. G. Ovens, Wright Aeronautical Corp., presented an analysis of the design features of the Mitsubishi-Kinsei engine which was shot down somewhere on the American battle front. Parts of the engine were shown in the exhibit hall.

A. W. Herrington, SAE president, and president of the Marmon-Herrington Corp., who returned from his mission to the Far East recently, made a short talk on morale and the objectives of the U.S.A. in this war.



Mammoth Martin Flying Boat

Far exceeding in size and load-carrying capacity any flying boat in existence, this newly designed 250,000-lb plane, according to Martin engineers, can be put into production at any time. Capable of carrying 102 passengers, each with 80 lb of luggage, plus 25,000 lb of cargo in a 13-hour trip to London, the ship, although designed for commercial use, could serve well as a military transport.

Nelson Lauds Industry's Production Achievements

WPB Chief Assigns to Detroit the "Hard Nuts to Crack"; Chrysler Breaks Ground for Huge Aircraft Engine Plant

Confirming the fact that the automotive industry has made a rapid transition from the production of peace-time products to all-out war production, Donald M. Nelson, chairman of the WPB, lauded the energy and enthusiasm of the industry on a recent trip through several Detroit war plants.

"I'm proud of the automobile industry," Nelson said after his first wartime visit to the Ford bomber plant and the Chrysler Tank Arsenal. He said the application of the industry's mass production genius to war problems had made it possible to cut many corners in manufacturing. This is one of the reasons back of the WPB decision not to build any more new plants than are absolutely essential for the immediate war effort. New war plants now in operation and those converted from making civilian goods have revealed greater capacity than was originally anticipated. Since full and complete production in 1942 and 1943 is the immediate aim of the United Nations in their drive to beat the Axis, it was decided not to waste steel on building plants that would not be in operation until late 1943 or 1944.

Nelson stated that Detroit had not reached the saturation point on war orders. Detroit manufacturers have the productive skill for the difficult manufacturing jobs, according to the WPB chief. A shortage of manpower may prove the Detroit bottleneck when peak production is achieved. When that point is reached, the WPB may take the easier production jobs out of Detroit and leave the automobile manufacturers to concentrate on the "hard nuts to crack."

Latest and biggest war factory which the automotive industry will operate will be the Dodge Chicago Aircraft Engine plant, a huge one-story structure which is expected to manufacture high-output aircraft engines when production is begun some months hence. Ground already has been broken for this plant, which it is believed will house the largest plant area under one roof ever built, surpassing even the tremendous Ford bomber plant at Willow Run.

Originally designed for structural steel construction by Albert Kahn, the architect, the plans were changed to reinforced concrete when the War Production Board decided to limit steel for new plants in order to feed the huge demands for armaments needed at once by the United Nations to fight the war. A new type of factory design was conceived that will require only 2.7 lb. of steel per sq. ft. of floor area instead of the 5 to 12 lb. generally used in conventional structural steel design. Enough steel will be saved in the projected plant to build 14 destroyers.

The economy in steel is achieved by utilizing a new type of overhead arch-rib construction which economizes on reinforcing steel and at the same time provides both spaciousness of the building and ready attachment of monorails, trolleys, hoists, and pipelines. A further saving in steel has been achieved by using a new "victory sash" instead of the usual steel window sash. The windows extend completely around the building, which will be mechanically ventilated. A new type of wood picket fense, which will extend nearly four miles around the building and grounds, will save an additional 125 tons of steel by replacing the conventional chain-link fence.

Plans for training the huge factory personnel, estimated at upwards of 45,000 workers, already are being drafted by the Chrysler Corp. The entire personnel will have been trained by the time the new plant is ready to start mass production. More than 50 top production executives, headed by William J. O'Neil, president of the Dodge Division who will serve as general manager, are being selected and trained for their new positions. More than 250 instructors will be trained to teach the thousands of employes the manufacturing techniques and processes of producing high precision aircraft engines.

Another Chrysler war project is the operation of a midwest plant that is turning out bullets by the millions and cores for armor-piercing cartridges, according to President K. T. Keller. Chrysler also is producing shell forgings at a rate of more than 90,000 monthly, trailer fire pumps, small barges powered by marine engines, air raid sirens, and airplane compasses.

Keller said recently that the production of B-26 bomber fuselage sections would be increased 150 per cent in the near future. He asserted that the corporation is not going into aircraft manufacturing after the war.

Fisher Body Division of General Motors is shipping parts for Boeing B-17 bombers in carload lots, according to E. F. Fisher, general manager. Shipments of exhaust manifolds and fixed and removable cowlings began 30 days after tools for the job were received.

(*Turn to page* 52, *please*)

Pool Experience to Study Synthetic Rubber

Pooling all the technical experience of U. S. industry on the subject, the tire committee of the automotive and rubber industries, a branch of the SAE War Engineering Board, is making available to the government a voluminous amount of research on rubber tires. Years of research by the tire and automotive companies have been summarized and made freely available to the authorities in Washington.

The hope of the committee is to provide an "interim" tire from leftover materials remaining after military needs are filled. This will in no way encroach upon the government's synthetic rubber program based on Buna S. The committee is hopeful of developing some non-critical material that will be suitable for retreading the worn casings of present tires. This "interim" tire may limit the speed at which the automobile can be driven, and it may have a comparatively short life, but it would provide a means for keeping millions of essential automobiles used by war plant workers and others in operation and forestall paralysis of U. S. civilian transportation.

No immediate solution of the problem is just around the corner, according to James C. Zeder, chief engineer of Chrysler Corp., who is chairman of the tire committee as well as chairman of the War Engineering Board. But this pooling of all the engineering and research on the subject by the top-ranking men of the nation is regarded as a definite step forward. It enables industry to combine its talents and eliminates a duplication of effort. Such cooperation on other critical materials like copper, chromium, tin, and nickel, has brought tangible results from committees of the War Engineering Board.

Members of the tire committee besides J. C. Zeder are: C. F. Kettering of GM and Fred M. Zeder of Chrysler representing the National Inventors Council; J. M. Crawford of Chevrolet and R. H. McCarroll of Ford representing the War Engineering Board; Dr. E. B. Babcock of Firestone, Dr. S. M. Cadwell of U. S. Rubber Co., Dr. Howard E. Fritz of Goodrich, E. F. Wait of Ford, W. M. Phillips of GM, and W. J. McCourtney of Chrysler, representing the research departments of the tire and automobile companies. Ray C. Sackett of the SAE is secretary of the committee which meets intermittently on call.

Dunlop, General Tire, and Seiberling also have been asked to participate in the committee effort. In addition, Monsanto Chemical, Dow Chemical, Standard Oil of New Jersey, Hercules Powder, and DuPont have made available their research studies.

Years of experimenting by the tire and automobile companies seem to show that a substitute non-rubber wheel in place of a rubber-tired one is not the solution to the problem. Wooden wheels have proved unsatisfactory, and the use of steel involves a material which is rapidly becoming more critical. Rebuilding worn casings appears to offer the most hope.

Predict Peak Detroit Employment by 1943

Survey, Conducted for WPB, Sets Total of 746,000 War Workers; Labor Shortages Serious in Several Regions

Peak labor employment in Detroit war manufacturing industries, including many automotive plants, will be reached in the summer or fall of 1943, according to long range estimates by the U. S. Employment Service in a survey made for the War Production Board. Manufacturing employment at the peak will total 746,000 employes, according to a survey made for Ernest C. Kanzler, regional WPB chief. This is more than 200,000 workers above the May employment total of 524,000 employes. However, it is somewhat less than a previous estimate of a peak of 830,000 workers which would be required in the Detroit area.

No large-scale migration of workers from other areas is anticipated in the next six months by Kanzler because the situation can be taken care of by more intensive use of local manpower resources. This includes intensive training and upgrading programs, transfer of workers from non-manufacturing and non-essential manufacturing occupations to war work, and greater employment of women, minors, and Negroes. November employment is expected to require 660,000 workers. The Detroit area's future labor requirements were based on a careful survey of 25 large companies that employ approximately two-thirds of the manufacturing workers in the vicinity.

A shortage of 157,000 workers is possible by the middle of 1943 because the net requirements will be increased by the draining off of considerable manpower for the armed forces through selective service. However, Paul V. McNutt, administrator of the War Manpower Commission, has asked local draft boards to consult with federal employment service officials before calling into the Army any individuals skilled in critical war occupations. This presumably would include tool designers, for which there is only one available for every 51 needed, and toolmakers, where there is only one for every 25 needed.

So critical has the situation become in some classifications that there has been widespread "pirating" of skilled labor. Manufacturers with cost-plus contracts have made tempting offers to workers in other plants, just adding the additional labor costs to the expense of the contract. This has unnecessarily increased war production costs and disrupted operations in some plants which had their workers lured away. The War Manpower Board has proposed the "freezing" of workers in certain critical occupations to forestall this "pirating" practice. Under this plan, it is possible that the hiring for such occupations would be handled through the U. S. Employment Service and plants not doing a sufficient amount of employe training and upgrading for their own future needs would be denied the right to employ men through the Service. Announcement of the impending action by McNutt without any immediate directive from the War Manpower Commission has had the unfortunate result of sending workers shopping for better jobs in some areas so they will be "frozen" into higher paid brackets. This has tended to cause just such job shifting as the order will be designed to stop.

On a nation-wide scale, it is estimated that 10,500,000 workers will be hired for war production jobs in 1942, augmenting the 7,000,000 war workers that filled such occupations last January 1. Of these new war workers, seven to eight million will come from non-defense industries, many of which have ceased producing civilian goods; 400,000 to 600,000 will come from farms; 400,000 will come from the ranks of the self-employed, such as professional men; 1,500,000 will come from the unemployed; and 2,000,000 will be housewives, youths, and older workers not listed as part of the regular working force.

Labor shortages are now current in Hartford, Conn., Buffalo and San Diego, Cal., all of which are aircraft manufacturing centers. The aviation industry, which employed 465,000 workers at the beginning of 1942, is expected to have more than 1,000,000 employes

(*Please turn to page* 50)

Ryerson Stocks New NE Alloy Steels

Joseph T. Ryerson & Son, Inc., has announced the addition of the new NE (National Emergency) alloy steels to its warehouse stocks. The "lean" alloys, recently established by the metallurgical staff of the WPB to help conserve nickel, chromium, vanadium, etc., will be carried in six different analyses in sizes ranging from ½ to 7 in.

Add Floor Space

Monroe Auto Equipment Co. is building a factory addition that will add 50,000 sq ft to the floor area and will increase this space by 70 per cent. The company is engaged in production on naval and tank ordnance material.

CALENDAR

Conventions and Meetings

Industrial Salvage Conference, New York .....June 17

ASME-SAE, Oil and Gas Power Conference, Peoria .....June 17-19

Natl. Aeronautic Assoc., Annual Mtg., New York City .....June 19-20

Eastern Photoelasticity Conference, Boston .....June 20

Automotive Engine Rebuilders Assoc., Cleveland, Ohio .....June 22-24

American Society for Testing Materials, Atlantic City, Annual Mtg....June 22-26

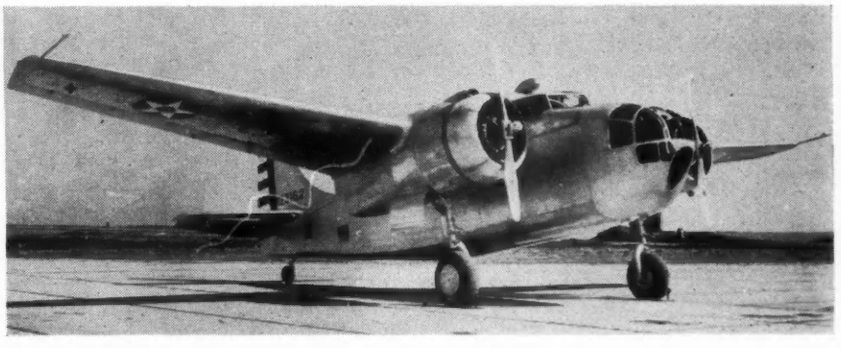
National Petroleum Association, Atlantic City, Annual Mtg. .....Sept. 16-18

Natl. Safety Council, Chicago, Annual Mtg. .....Oct. 5-9

Natl. Metal Congress & Exposition, Cleveland .....Oct. 12-16

American Welding Society, Detroit, Annual Mtg. .....Oct. 12

Natl. Lubricating Grease Inst., New Orleans, Annual Mtg. .....Oct. 25-29



Boeing AT-15 Crew Trainer

This plane, which is being built by Boeing in a mid-west plant, is specifically designed and equipped for the training of pilots, bombardiers, navigators, and gun crews. It is in reality a small bomber, fitted with bomb racks, a power-operated gun turret, regulation bombardier's position, and full radio and navigational installations. Constructed largely of non-strategic materials, the trainer consists of a fabric-covered fuselage formed on a steel-tubing framework, and plywood-covered wings and tail surfaces. The plane, capable of a top speed in excess of 200 mph, is driven by P & W engines equipped with Hamilton propellers. It has a wing spread of approximately 59 ft and a length of 42 ft.

International

Curtiss-Wright Seagull

The Curtiss-Wright Seagull (SO3C-1) a two-place, longrange scout observation plane, is now being produced in a mid-west plant of the Curtiss-Wright Corp. Either wheels or floats can be fitted to the plane which is designed for catapult operation from battleships and cruisers or for operation from an aircraft carrier. A Ranger engine, developing in excess of 500 hp., provides the power.

Steel Distribution Under New Regulations

Deliveries to Hinge More Heavily on Ultimate Use; Scrap Problem, Still Acute, Thwarts Efforts to Ease

By W. C. Hirsch

Distribution of steel will be carried out after July 1 under the Production Requirements Plan, preference under which will be based on a more rigorous scrutiny of where, when, and for what final assembly the steel is needed. If the plan works, as those who have formulated are confident it will, war contract plants will be decidedly the gainers, since, in addition to more efficient routing into those uses where the steel is most urgently needed, a certain tonnage that otherwise might be diverted to marginal products will be added to what is available for the highest rated conversion.

The march of events has for the time being made calculations based on statistics and estimates of war needs a poor guide. The immediate demand is apparently for all-out production of primary steel and the total distribution of this yield to none but finishing channels with a vital part in the war program. While progress toward this goal has been uninterrupted, it is noteworthy that those obstacles, which made themselves felt long before Pearl Harbor, continue as the source of the outstanding shortcomings.

The scrap problem is as acute as it has been. Spokesmen for the scrap iron dealers blame direct buying by some steel mills and insistence by others on lower-than-ceiling prices for tightness in the supply, while the steel industry is seeking to remedy the situation by selling the public through a large advertising campaign on the need of conserving every piece of scrap and of making it speedily available for re-use.

Enlarged blast furnace capacity is beginning to bear fruit, however, and the outlook is at least no more serious than it has been.

Production of steel plates also continues to be a source of vexation. So large a part of sheet-rolling capacity has been given over to plate production, that sheet buyers find it difficult at times to get any sort of a promising place on mills' unfilled order books.

At the same time that the War Production Board announced that tin supplies used in non-critical products would be cut another 10 per cent, effective July 1, it became known that negotiations with Bolivia are under way for lifting the price for tin ores, shipped to the new United States smelting plant, by approximately 20 per cent. Bolivia's production last year aggregated 46,000 tons, and as the result of the higher price is expected to attain a 50,000-ton-per-year output in a very short time. The ceiling price for the metal is not expected to be altered, remaining at 52 cents a pound. The higher price paid to the Bolivian producers will, so it is reported, be a subsidy from the United States Government to encourage the stepping up of production. As the United States Gov-

(*Turn to page* 52, *please*)

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

Relatively stable levels of general business activity are reported. The seasonally adjusted index of *The New York Times* for the week ended May 30 was 132.0 per cent of the estimated normal, as against 132.3 for the preceding week and 129.4 a year ago. The unadjusted index of *The Journal of Commerce* for the same period, reflecting the influence of a holiday, declined to 119.5 per cent of the 1927-29 average from 121.0 for the week before.

Department store sales during the week ended May 30, as reported by the Federal Reserve Board, were 11 per cent below those a year ago, registering a widening gap between current sales and comparable business last year. For the four weeks then ended, the total was equal to the corresponding sum in 1941, with sales in 1942 to that date 17 per cent greater than the comparable value last year.

Railway freight loadings in the week ended May 30 totaled 795,756 cars, 5.0 per cent fewer than the number for the preceding week and 0.8 per cent below the figure a year ago.

Electric power output declined less than seasonally in the same period and was 12.5 per cent above that a year ago, as against a corresponding gain of 11.2 per cent shown a week earlier.

Crude oil production during the week ended May 30 averaged 3,877,300 barrels daily, 278,300 barrels above the figure for the preceding week and 402,800 barrels more than the average output recommended by the Office of the Petroleum Coördinator.

Average daily production of bituminous coal in the same period was 1,957,000 tons, as compared with 1,890,000 tons for the week before and 1,767,000 tons a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended June 5 stands at 106.7 per cent of the 1926 average, one fractional point below the level a week earlier, as against 92.8 a year ago.

Member bank reserves rose $186 million during the week ended June 3 and estimated excess reserves increased $240 million to a total of $2780 million. Business loans of reporting members declined $56 million in the preceding week and stood $884 million above the total a year ago.

40 YEARS AGO

St. Louis, Mo., June 7

Editor Horseless Age:

I read with much satisfaction your recent editorials in regard to the proposed organization of a society to be known as the American Society of Automobile Engineers (A.S.A.E.). The automobile industry certainly needs, especially at this time, the guiding hand of such a society, and I know of no reason why the organization should not be an eminent success if properly carried out by men of high character and technical ability. The writer has had six years' experience in automobile building, and therefore speaks from experience in presenting the above opinion.

J. C. H., M. E.

From *The Horseless Age*, June 11, 1902.

Navy Orders Powerful Liquid-Cooled Engine

Breaking Precedent, Contract Calls for Manufacture of Lycoming-Developed Engine by Branch of Aviation Corp.

Presaging a radical change in future naval aircraft design, the Navy Department has announced that it will use a new liquid-cooled aircraft engine of nearly 2000 hp. This engine will be produced in a new plant under construction in Ohio to be operated by the Liquid-Cooled Engine Division of the Aviation Corp. This is a newly created division of Aviation Corp., whose Lycoming Division at Williamsport, Pa., developed the new liquid-cooled powerplant.

It will mark the first time in recent years that the Navy has ordered liquid-cooled engines. Heretofore it has relied on the radial air-cooled powerplants for all its aircraft, including fighter planes, dive bombers, observation planes and patrol bombers. The largest of these radial engines develop about 2000 hp. William F. Wise, executive vice-president of the Aviation Corp., stated that the new engine is so powerful that it compares favorably with the largest type of air-cooled engines now in production.

The Army Air Corps uses several types of fighter planes powered by liquid-cooled engines, including the Lockheed P-38, the Bell P-39, and the Curtiss P-40, all using the Allison engine, and the Curtiss Warhawk, latest version of the P-40, which uses the Rolls-Royce Merlin engine manufactured by Packard. Use of the liquid-cooled engine with its lesser frontal area permits more streamlining of the plane and allows the designer more latitude in deciding upon engine placement.

United Aircraft Corp., whose Pratt & Whitney Division is one of the largest manufacturers of radial engines, recently revealed that six other manufacturers are making these engines under license, for which they pay the nominal fee of $1 per engine. These companies are Ford, Buick, Chevrolet, Continental, Nash-Kelvinator, and Jacobs Aircraft Engine Co. United Aircraft also is building an $85 million engine plant at Kansas City, financed by the government, which will be operated without a profit to the corporation.

Eugene E. Wilson, president of United Aircraft, recently praised the automotive industry for its cooperation and efficiency in converting its productive capacity to aircraft engines. He contrasted the difference in manufacturing practice from the automotive custom of frozen designs for mass production purposes to the philosophy of flexibility in production which constantly changing aircraft designs require.

"It is to the everlasting credit of the automotive industry," Wilson said, "that it adopted our philosophy bodily and put it into effect. To do this it had to scrap its old ideas and old tools, learn our specialized technique, and even build new buildings and train new crews. The rapidity of the conversion of the automotive industry is another of the miracles of our time."

Wilson told how Pratt & Whitney engineers recently disassembled one of their engines and another of the same type manufactured by Buick. All the parts were mixed together and two composite engines were reassembled. Both of them then passed the ensuing tests with flying colors, proving the interchangeability of parts without any fitting of any sort.

Douglas Aircraft Co. recently revealed in a report to its president that the company has begun operations in a government-built plant in Oklahoma and has completed plans for a second plant in another part of that state.

Vega Aircraft Corp. is six months ahead of schedule in the assembly of Boeing B-17 bombers, according to President Courtlandt S. Gross. Initial tooling was started less than a year ago. Vega is the first plant to start final deliveries under a pooled facilities plan for bomber production arranged by the Air Corps.

Production at Consolidated Aircraft Corp. is considerably in excess of production schedules, according to President Harry Woodhead. Adoption of assembly line principles has made possible this accelerated production rate. Approximately 40 per cent of the company's production work is let out on subcontracts.

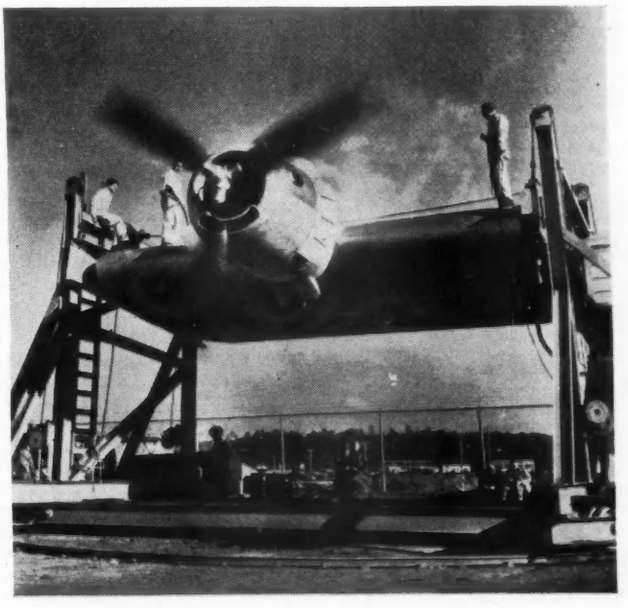
More ODT Field Managers

Eighteen additional field managers were recently appointed by the Office of Defense Transportation. The new managers, and the cities from which they will operate, are:

Billings, Mont. — Emmett Fogarty, of Butte, former engineer for the Montana Railroad Commission. Milwaukee, Wis.—Russell R. Lynch, of Milwaukee, formerly on the staff of the Wisconsin Public Service Commission. Oklahoma City, Okla.—William W. Warren, of Oklahoma City, former manager of the Warren Transportation & Storage Co. Salt Lake City, Utah—Richard W. Candland, of Salt Lake City, former secretary and general manager of the Utah Motor Carriers Association. Wichita, Kan.—W. R. Bartling, of Wichita, former traffic manager of the Universal Motor Oils & Fuels Company. Albany, N. Y.—Lawrence F. McDonald, East Greenbush, N. Y., former traffic manager of the American Meter Co., Albany. Buffalo, N. Y.—Floyd B. Piper, Buffalo, N. Y., former general manager of Direct-Winters Transport, Ltd. Charlotte, N. C.—LaFayette R. Stallings, Rocky Mount, N. C., former partner and general supervisor of Stallings Transfer Service. Chicago, Ill.—Harry L. Gormley, New Castle, Pa., former secretary-treasurer and operating manager of the Keystone Lawrence Transfer & Storage Co., New Castle. Cincinnati, O.—Henry A. Leachman, Ft. Thomas, Ky., former assistant traffic manager of the Continental Freight Forwarding Co. Cleveland, O.—C. R. Allen, Cleveland, O., former superintendent of trucks for the Auto Haulaway Co. Des Moines, Iowa — John H. Gillespie, Des Moines, Iowa, former secretary of the Iowa Motor Carriers Association. Houston, Texas—J. R. Quattlebaum, Nacogdoches, Texas, former highway insurance investigator. Minneapolis, Minn.—Frank T. Corcoran, St. Paul, Minn., former official of the Minnesota State Department of Highways. Pittsburgh, Pa.—Charles T. Walker, Cincinnati, O., former assistant general freight agent for the Inter State System, Grand Rapids, Mich. San Antonio, Texas—John G. Ross, Austin, Texas, former inspector of law enforcement, chief clerk of the motor transport division and junior examiner for the Railroad Commission of Texas. Shreveport, La.—John F. Dawson, Baton Rouge, La., former assistant chief of the motor transportation division of the Louisiana Public Service Commission. Toledo, O.—H. Martin Walker, Toledo, O., former terminal manager of the Long Transfer Co.

Flightless Test

In order to test engine installations of new type planes without waiting for the completion of the prototype, Boeing engineers have constructed this turntable-mounted wing section. Many of the tests carried out in actual flight can be made here. A corner of the "control cabin," complete with engine test instruments, appears at the far right.



PUBLICATIONS

A technical bulletin covering current revised standard dispersons of **dag** colloidal graphite in various carriers has been issued by Acheson Colloids Corp. Included in the bulletin are major applications for the use of colloidal graphite dispersons, such as **Aquadag** (in water), **Oildag** (in petroleum oil), **Castordag** (in castor oil), **Glydag** (in glycerine), as well as **dag** dispersions in the more volatile liquids such as mineral spirits. Also covered are **Prodag,** a concentrated graphite suspension in water, largely used for parting compounds, coarse wire drawing and for forging lubricants, and the new type 1175 **dag** graphite dispersion in petroleum oil designed for use in heavy-duty forging and shell forging.*

Catalog No. 41 has just been published by Pier Equipment Mfg. Co. It contains complete descriptions of various essential elements and types of foot-operated and motor-driven **automatic welders,** including a description of the new **Type 47 Automatic Weld Timer** for use with any size manually-operated Ace Welder.*

Hobart Bros. Co. announces a new book, **Lessons in Practical Arc Welding,** which contains the complete series of 41 arc welding lessons offered at the Hobart Trade School. The booklet is priced at 75 cents per copy and may be obtained by writing Hobart Bros. Co., Troy, Ohio.

The current issue of Ex-Cell-O Tool Tips contains an article on single- and multi-point cutting tools for mass production.*

Complete industrial **spray finishing systems** are described and illustrated in Binks Mfg. Co.'s catalog No. 80.*

Helping Industry Help America is the title of a new booklet by Sun Oil Co. It contains actual case histories of how engineering service in applying petroleum products in metal working, general lubrication, processing, mining, textile manufacturing and other operations is helping American industry produce more.*

A booklet on U. S. Government **Specification Finishes** has been published by Maas & Waldstein Co., providing makers of armament products with essential information on their finishes that have been made to conform with various U. S. Government specifications.*

An illustrated booklet by Westinghouse Electric & Mfg. Co., describing and illustrating its new electronic welding timer, gives application information and special design features. Diagrams are also included showing complete sequence of operation in pulsation welding and how electronic timers and other controls fit into the average resistance welding circuit.*

A new controller catalog, No. 900-E, offered by C. J. Tagliabue Mfg. Co., describes the **Tag** line of non-indicating temperature and pressure controllers.

A 48-page illustrated book on conservation of rubber products in industry has been published by United States Rubber Co. Complete suggestions are given for the proper care of important rubber products from initial design through inventory and storage to use, maintenance, inspection, and repair. The book is titled **First Aid To Industry In Conserving Rubber.***

Sturdimatic Tool Co. has issued a four-page catalog giving complete information and specifications concerning standard **Morse taper live centers.***

The current issues of *Flashes,* Thompson-Gibb Electric Welding Co.'s house organ, gives a description of its new Thompson **Model 25 Medium Series Seam Welder.***

Federal Products Corp. has issued a booklet entitled **Shell Dial Indicator Inspection Gages.***

* Obtainable through editorial department. AUTOMOTIVE *and* AVIATION INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia, Pa. Please give date of issue in which literature was listed.

Peak Employment by '43

(*Continued from page* 47)

on the payrolls by Jan. 1, 1943.

Negotiations between the Ford Motor Co. and the UAW-CIO over a new contract got under way June 2 at Detroit. The union demands of a $1-per-day wage increase and a $100 defense bond bonus are essentially the same as those demanded of General Motors. The G-M-union negotiations, now before a special three-man panel of the War Labor Board, have been adjourned until June 16. When reached, the agreement will be retroactive to April 28. The Ford-union contract expires June 20.

Meanwhile, some minor disturbances have begun to mar the labor calm that generally has prevailed since Pearl Harbor. Two hundred foremen in the spring and upset department at the Ford Rouge plant staged a three-day walkout in protest against working 8½ hours daily instead of the eight hours put in by production workers. The Dodge Truck plant was idle part of one day when 700 men on the final assembly line walked out in protest against the transfer of 20 Negro workers from another Dodge plant. International officers of the UAW-CIO overruled Local No. 140, pointing out the union's constitutional guarantee of racial equality.

A day-old strike at the Sealed Power Corp. in Muskegon was settled by compromise after 1000 workers walked out in protest against employment of a woman cost and production checker on the aircraft piston line. The local union, which recently voted to desert the AFL and join the CIO, had charged that the woman's presence involved a speedup. A dispute involving 320 workers at the Detroit and Marysville, Mich., plants of Chrysler Corp. was certified to the War Labor Board after Chrysler sought to convert salaried employes to hourly wage rates.

A 5-day strike of 250 employes of the Federal Engineering Co. in Detroit was terminated after Major Geo. E. Strong of the Central Air Corps Procurement District served a "work-or-fight" ultimatum on the strikers. The company makes important aircraft parts. Major Strong said that workers subject to the draft would be called into the Army if they did not return to work. A jurisdictional dispute caused the walkout. The Society of Tool and Die Craftsmen, an independent union, has held bargaining rights in the plant for four years, but Local 157 of the UAW-CIO has gained some members and demanded an NLRB election.

Hobart S. Johnson

Hobart S. Johnson, 68, chairman of the board of directors and former president of Gisholt Machine Co., Madison, Wisc., died late last month at his Maple Bluff home after a long illness.

MEN . . . . . .

Robert S. Betten, president of Rochester Sales Corp., has been appointed associate chief of the tire rationing branch of OPA. **John C. Stedman,** associate professor of law at University of Wisconsin, has been named to head the legal department of the tire rationing branch.

Charles O. Ball, chief engineer: **Rodger J. Emmert,** factory manager, and **William B. Livingston,** assistant to the president, have been elected vice-presidents of Yellow Truck & Coach Mfg. Co.

John S. Sayre, formerly head of the defense division of Fruehauf Trailer Co., has been named head commodity specialist in charge of the Automotive and Trailer Equipment Section, Purchases Division, of WPB.

K. T. Keller, president of Chrysler Corp., has been appointed a member of a voluntary advisory staff to Maj.-Gen. Levin H. Campbell, new chief of ordnance of the U. S. Army.

Joseph B. Eastman, director of the Office of Defense Transportation, was awarded the honorary degree of doctor of laws at the annual commencement exercises of the University of Michigan, May 30.

Walter Martin, assistant service manager of the Pontiac Motor Division, has been appointed head of the technical information section of the Pontiac anti-aircraft gun training school, which is under the direction of **D. U. Bathrick,** Pontiac general sales manager. **O. M. Dahl,** former western service manager, is chief school instructor.

D. E. Ahrens, general sales manager of Cadillac, has been named director of the Cadillac army combat vehicle maintenance school. **W. A. Houser,** general service manager, will be supervisor of the school. **A. A. Weidman,** formerly superintendent of passenger car final assembly, has been appointed superintendent of the welding and sheet metal divisions for combat vehicles and **A. J. Renc,** formerly assistant to Weidman, becomes superintendent of final assembly for combat vehicles.

Dr. Orlo L. Crissey, formerly director of the Flint Guidance Center, a publicly supported institution for vocational guidance, has been appointed director of employee vocational training for the AC Spark Plug Division of General Motors.

Emmet Sheahan, formerly general manager of the tire division of U. S. Rubber Co., has been named assistant to the president, Francis B. Davis, Jr. **John W. Bicknell,** managing director of the plantation division, has been loaned to the Rubber Reserve Co. and elected a vice-president to direct the government's wild rubber procurement program.

V. I. Montenyohl, vice-president of the B. F. Goodrich Co., has resigned because of ill health after 35 years' service with the company.

Joseph E. Lowes, Jr., formerly an account executive with Ruthrauff & Ryan, Inc., has been named advertising director of Fairchild Engine & Airplane Corp.

L. P. Jackson, formerly director of engineering, has been named vice-president in charge of engineering of Mid-West Abrasive Co. **Roy A. McElhinney,** formerly superintendent of production, has been made vice-president in charge of manufacturing.

Gill Robb Wilson, president of the National Aeronautic Association, has been elected a trustee of Washington & Jefferson College.

Clyde Jordan was elected vice-president and manager of the line support division of Adel Precision Products Corp. **J. E. Hughes,** well-known flyer and aeronautical engineer, will be resident manager of Adel's new engineering service office in Dallas, Texas.

J. M. Barr, who had been continuing his previous duties as factory manager following his appointment as assistant general

(*Please turn to page* 52)

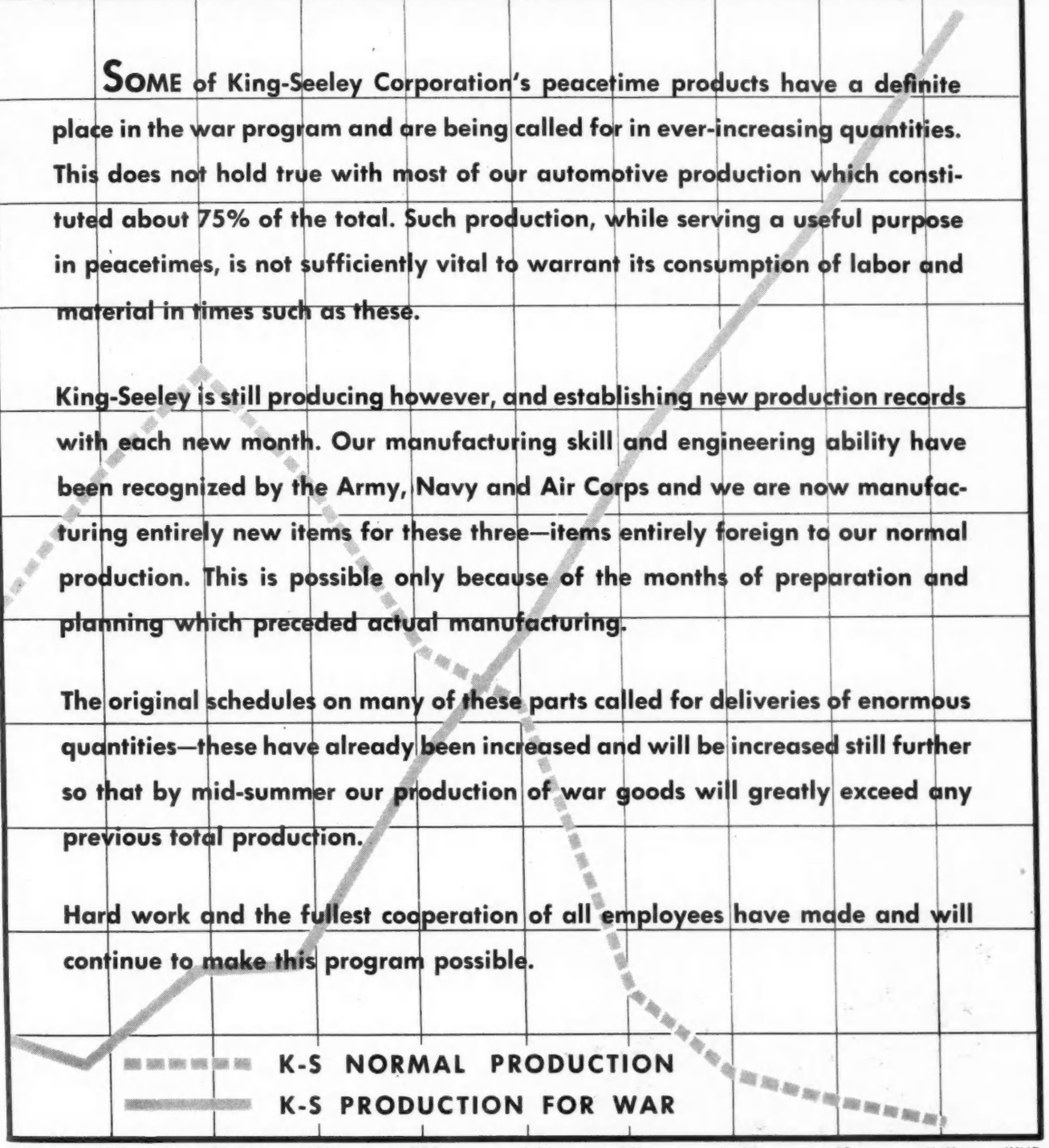
TRANSITION

SOME of King-Seeley Corporation's peacetime products have a definite place in the war program and are being called for in ever-increasing quantities. This does not hold true with most of our automotive production which constituted about 75% of the total. Such production, while serving a useful purpose in peacetimes, is not sufficiently vital to warrant its consumption of labor and material in times such as these.

King-Seeley is still producing however, and establishing new production records with each new month. Our manufacturing skill and engineering ability have been recognized by the Army, Navy and Air Corps and we are now manufacturing entirely new items for these three—items entirely foreign to our normal production. This is possible only because of the months of preparation and planning which preceded actual manufacturing.

The original schedules on many of these parts called for deliveries of enormous quantities—these have already been increased and will be increased still further so that by mid-summer our production of war goods will greatly exceed any previous total production.

Hard work and the fullest cooperation of all employees have made and will continue to make this program possible.



KING-SEELEY CORPORATION
ANN ARBOR, MICHIGAN

PEACETIME MANUFACTURERS OF K-S ELECTRIC TELEGAGES, K-S SPEEDOMETERS, HANDY VARI-SPEED GOVERNORS SERVO MECHANICAL GOVERNORS AND HANDY DOUBLE ACTION OIL FILTERS FOR THE AUTOMOTIVE AND ALLIED INDUSTRIES

MEN

(*Continued from page* 50)

manager of Vought-Sikorsky Aircraft several months ago, relinquished these duties on June 1 to devote his entire energies to his new office. Assistant factory manager, **B. T. Taliaferro** was promoted to factory manager; factory superintendent **John F. Hemmert** to assistant factory manager; assistant factory superintendent **Sydney Hexson** to factory superintendent and **Earle F. Fay,** general foreman of final assembly, to assistant factory superintendent.

Benjamin T. Salmon, formerly with Martin, has been appointed chief engineer of Ryan Aeronautical Co. **Millard C. Boyd** has been appointed chief development engineer and **Will C. Vandermeer** chief project engineer at Ryan.

Richard N. Armstrong, previously a member of the Iron and Steel Division of the British Purchasing Commission, has joined the Jessop Steel Co. and is associated with the Tool Steel Division.

Casey S. Jones, president of the Casey Jones School of Aeronautics, Inc., has been elected a director of National Aviation Corp. He succeeds **Nicholas S. Ludington,** who resigned to work with the Navy Dept. in Washington.

Charles L. Dearing, a member of the staff of Brookings Institute, specializing in economics and transportation, has been named a consultant in the Division of Transport Conservation of ODT.

William P. Gwinn, formerly assistant sales manager of Pratt & Whitney Aircraft Division, has been appointed assistant general manager.

James A. Herrington has been elected president of Knu-Vise, Inc. He was formerly general manager of the company.

Philip K. Hills, Chrysler European representative before the war and more recently special liaison executive for Chrysler Lend-Lease operations, has been commissioned first lieutenant in the U. S. Army air force.

Industry's Production Achievements

(*Continued from page* 46)

A new welding method has greatly reduced the production time for each part and also minimizes distortion of the metal.

Another GM division, the Cleveland Diesel Engine Division, has multiplied its production of powerplants for Navy ships 12 times since 1940. A new plant addition now contemplated will boost output another 50 per cent over the current rate. The division subcontracts 70 per cent of the engine work.

Oliver Lyttelton, British minister of production, had a boost for radial tank engines during a recent tour of Detroit war plants. He said that just before his departure from England for the U. S., he had received a radiogram from the British forces in Libya praising the performance of the radial engine and describing it as ideally suited to the M-3 tank. Recent discussion of the expanded medium tank manufacturing program has centered around the use of diesel, multiple automotive, and liquid-cooled aircraft type engines as powerplants in the new all-welded M-4 tanks.

Continental Motors Corp. is one of the biggest producers of radial engines for light and medium tanks. Continental recently completed its 10,000th military engine for the war effort. These range from 65-hp. engines for training planes to the 450-hp. Wright Whirlwind engines that power the medium tank. The company is currently engaged in doubling the capacity of its Detroit and Muskegon plants for the production of these engines. The Defense Plants Corp. has spent $23 million in expanding the capacity of Continental's plants, while the corporation itself is spending $3,800,000.

Forged Heads for Greater Power

Acme

Forged radial engine cylinder heads, formed from extruded aluminum bar stock, are said to effect great savings in production, provide greater strength and cooling capacity, and consequently a higher power output without an increase in engine weight. Developed by the Wright Aeronautical Corp. to replace sand-cast heads, the new forged heads are being produced with fewer rejections. In the photograph cooling fins are being cut by a high-speed milling machine.

Industry Committees Speed Ordnance Output

The War Department announced the formation of eight committees in the ordnance field to serve as the means for exchange of information, parts, raw materials, and other resources within an industry for the purpose of obtaining maximum final production in a minimum of time. The committees have been in process of organization since April 21, under the supervision of Major General Levin H. Campbell, Jr., the Chief of Ordnance, Services of Supply.

Delays in final production occasioned by the lack of a relatively few special parts have been markedly decreased as a result of the formation of the committees, which offer a mechanism for pooling the full resources of each industry to produce maximum capacity.

Following are the representatives of industry who serve as assistant chairmen of the committees:

Mechanical Time Fuze Committee: Roy T. Hurley, factory manager, Eclipse Machine Division, Bendix Aviation Corporation, Elmira, New York; Carbine Committee: D. M. Fincke, Assistant Works Manager, Underwood-Elliott-Fisher, Hartford, Connecticut; 37 mm. Tank and Anti-tank Gun Committee: Wilson Palmer, United Shoe Machinery Corporation, Beverly, Massachusetts; M 1903 Rifle Committee: G. O. Clifford, Remington Arms Company, Ilion, New York; Calibre .45 Pistol Committee: G. K. Howland, Remington-Rand, Inc., Syracuse, New York; Steel Cartridge Case Committee: C. L. Patterson, Corcoran-Brown Lamp Division, Electric Auto-Lite Company, Cincinnati, Ohio; Calibre .30 and .50 Metallic Belt Link Committee: W. A. Baker, Firestone Steel Products Company, Akron, Ohio; Calibre .30, M1, Rifle Clips Committee: R. B. Briton, Stanley Works, New Britain, Connecticut.

Purchase Tube Company

Calumet & Hecla Consolidated Copper Co. has purchased the assets of the Wolverine Tube Co., Detroit, and will operate it as the Wolverine Tube Division. The purchase price, approved by Wolverine stockholders in April, was $2,690,361.

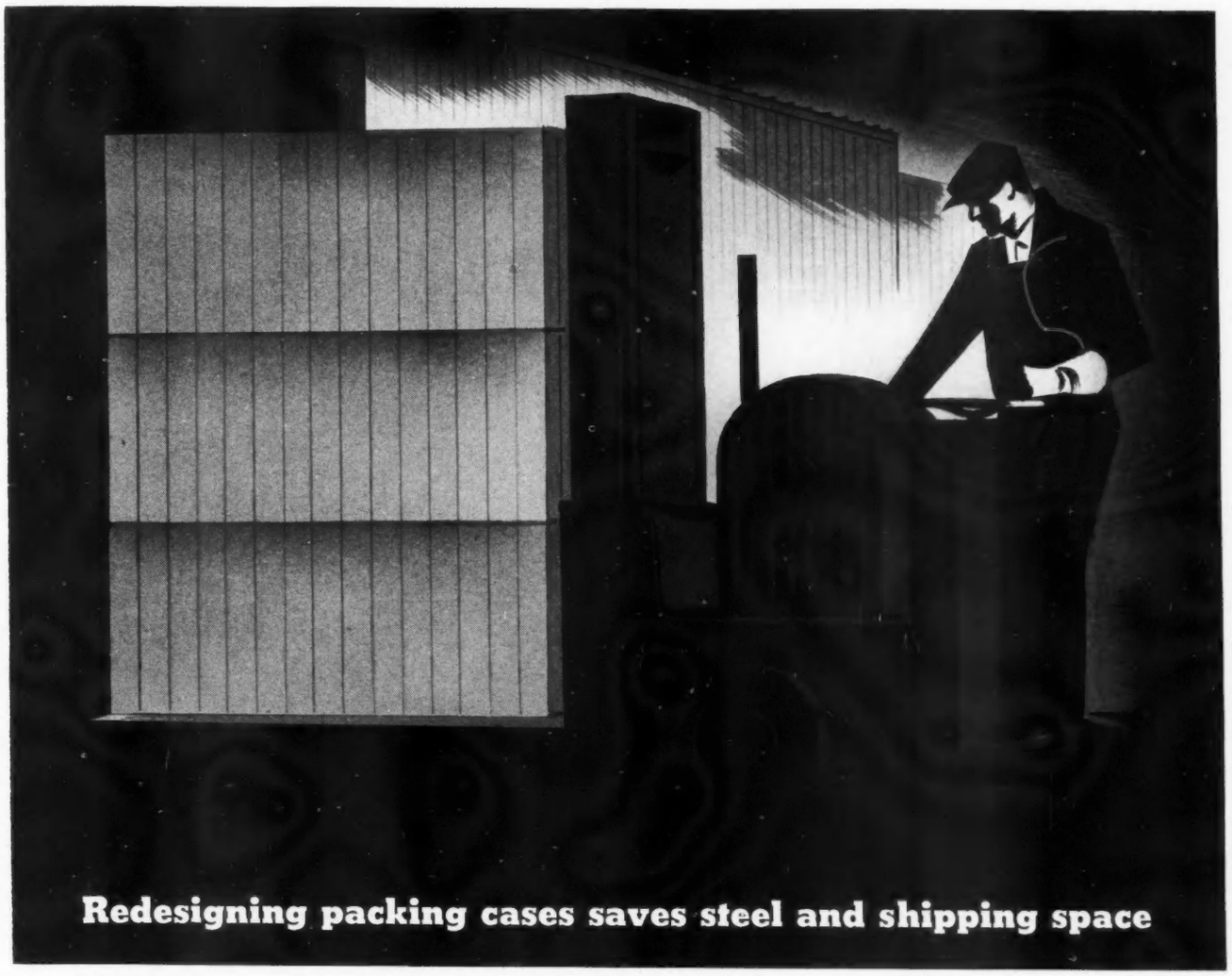
Steel Distribution

(*Continued from page* 48)

ernment will consume nearly all the Bolivian tin in war materials, private consumers will derive negligible benefit from this subsidy.

Adjustment of the price of silver to conform with the possible raising of the U. S. Mint official buying price, as the result of Congressional action, is something to be reckoned with as a potential development of the near future. Industrial demand for silver is breaking all records.

A recent statement by Col. Geo. S. Brady of the Board of Economic Warfare that aluminum production this year would be five times what it was in 1939, and that 60 times the tonnage of magnesium produced in 1939 would be available in 1942, comes as reassurance that the two principal light metals will be in abundant supply in 1943.



Redesigning packing cases saves steel and shipping space

Information Supplied by "Automotive and Aviation Industries"

A case in point is what has recently been done by a large manufacturer of airplane engines with respect to a matter normally considered of small importance.

New packing cases have been designed which feature simplicity of construction, added strength and materials-conservation. Concerning the latter — an extremely important matter right now — it was found that the substitution of two thin metal bands for the former outside bolted steel strapping and lifting eyes has saved over 500 tons of steel annually.

A slight reduction in the overall dimensions of one size of case now permits 20 cases of this size to be packed inside a typical freight car, whereas only 10 could be so packed formerly. Countersunk case handles, and the elimination of other previously-used protruding hardware, offers a smoother exterior, more compact storage, and less likelihood of damage to adjacent cases.

Simplified design makes it possible for four basic cases to care for the shipment of all engine types, whereas eight were formerly needed.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

Scrap Drive

(*Continued from page* 45)

The first report is to cover the month of June.

Automotive companies also have been urged to authorize their suppliers to scrap or dispose of all obsolete equipment or material held to the company's account. The potential scrap which the automotive industry can provide is difficult to determine in advance, as the industry constantly carries on salvage operations. In 1938, a comparatively low automotive production year, 1,040,000 tons of borings, turnings, sheet clips, and other waste were salvaged by the automobile industry. Steel scrap recovery under normal manufacturing conditions is composed of the iron of mill scale taken from forgings, compressed bundles of sheet cuttings from stamping departments, borings from castings, steel flashings from forge shops and smaller fragments shoveled into chip crushers. Copper and aluminum also are salvaged in some quantities.

The automotive industry is the first to engage in a cooperative scrap metal drive on an industry-wide basis, and, according to Charles McArthur, chief of the Industrial Salvage Section of the Bureau of Industrial Conservation, War Production Board, it is hoped that it will set the pace for the nation and stimulate other industries to follow this example. The anual requirements of the war production program at present call for 50 million tons of scrap iron to keep steel output at a maximum level. The WPB wants to build up at least a 10 million ton stockpile for next fall and winter, when the seasonal scrap iron collections fall off. There is particular need for heavy scrap which the automotive industry can supply.

Ernest C. Kanzler, chief of the Automotive Branch of WPB, said, "The automotive industry, which has taken the lead in the production of war goods, also may show the way and set the pace in turning unneeded machinery, obsolete equipment and other metal into scrap."

P. O. Peterson, director of purchases for Studebaker Corp., is chairman of the ACWP Salvage and Conservation Committee. Other members are Ray Ayer, of Chrysler Corp.; B. D. Kunkle, of General Motors; J. F. Page, of Packard; J. E. Padgett, of Spicer Mfg. Co., and J. D. Porter, of Federal Motor Truck Co.

As another adjunct of the scrap metal drive, the dealer organizations of the automobile industry will cooperate in a nation-wide house-to-house salvage campaign to be inaugurated June 29. Retail dealer establishments may be used as receiving depots; dealers and wholesalers will serve as members of state and local salvage committees. Donald U. Bathrick, Pontiac sales manager, will direct this activity for the industry.

Cadillac Trains Mechanics at Fort Knox

Cadillac Motor Car Division of General Motors has begun operation of a school to train U. S. Army instructors in the maintenance of combat vehicles. A three-week course for Army instructors from the Armored Force at Fort Knox, Ky., covers light repairs and maintenance of Cadillac-built military vehicles. There also is a five-week training course for ordance mechanics on heavy vehicle repairs.

The school is under the direction of experienced Cadillac service personnel, headed by W. A. Houser, general service manager and school supervisor. D. E. Ahrens, Cadillac general sales manager, has direction of the entire school program. Cadillac-trained men also are augmenting the teaching staff at the General Motors Institute in Flint.

Another phase of Cadillac's war activity is the establishment of a field engineering contact organization which will report on the performance of Cadillac built vehicles in the field under all kinds of conditions. Four veteran Cadillac district parts and service managers are under training as field observers. They are G. M. Tinney, of Rochester, N. Y.; W. G. Smith, of Boston; S. L. Quisenberry, of Los Angeles, and H. F. Pancoast, of Chicago.

New Gage Plant

Vinco Corp., Detroit gage manufacturer, has begun construction of a new $1-million plant financed by the Defense Plants Corp.

Common-Sense Conservation in Welding Practice

(*Continued from page* 31)

any piece of hose no matter how tough it is, the worker should be warned to use the proper pressure, which is usually lower than the one he would pick for the job. Even though hoses for use on welding and cutting equipment are designed to withstand certain prescribed pressures. This is no excuse for leaving a job with the gas turned off at the torch. Only turning off the gas at the tank will relieve the pressure in the hose.

Some jobs do require long stretches of hose from the tanks to the working areas, but more often than not a careful checkup will show that hundreds of feet of hose are serving no useful purpose. Just as electrical pressure drops in a length of wire, so gas pressure drops in a piece of hose. Consequently, both length and diameter should be considered. Furthermore, longer lengths are more susceptible to damage by moving vehicles, shifting of equipment, etc.

In conclusion, there is really nothing baffling about this business of conserving a much needed industrial gas. With additional uses cropping up every day, it is all the more important that each user give careful consideration to common-sense conservation. A burning torch left idle for three minutes out of every hour is wasting 5 per cent of its gas consumption, and this waste in terms of last year's consumption alone is 360 million cu. ft.—1,636,000 tankfuls!

Rotol Contra-Rotating Propeller

(*Continued from page* 37)

take both journal and centrifugal loads. Secured by a series of studs screwed to the bottom faces of the adaptors are differential actuating rings, which consist of circular plates having two concentric rings of holes. Some of the inner holes are used to secure the actuating rings to the adaptors, while the base of each operating pin is secured to one of either the inner or the outer rows of holes. The number and position of the holes are such as to permit, by this arrangement, a vernier adjustment to be provided for the operating pins relative to the blade.

The operating links of the front propeller consist of three forked rods attached by brackets to the rear face of the operating cylinder and connected to the blade operating pins by internal links journalled to the pins by "Tufnol" bushes, which are free both to slide and to turn in their housings. By the means described, fore and aft movements of the operating cylinder cause the blade operating pins to follow a curved path, the floating bushes sliding in their mountings to accommodate relative movement between the parts.

The links within the front propeller are double-ended and pass through rearward to be connected by means of a "cross-head" to the inner race of the link thrust transfer bearing, which encircles and slides on the front propeller shaft in the space between the two propellers. The outer race of this bearing connects the linkage to the rear propeller unit, giving the blades of the latter rotational movement in the opposite direction by reason of divergence in the location of the offset operating pins relative to those of the blades of the front propeller.

Fore and aft movement of the single hydraulic cylinder turns the blades of both propellers equally. Hydraulic pressure for this purpose is provided by a standard "constant speed" or governor unit as used with the conventional Rotol hydraulic propellers. As the controls are also the same no new technique is called for when the contra-rotating type of propeller is fitted.

IT WON'T BUDGE

GASOLINE, KEROSENE, FUEL OIL, HOT LUBRICATING OIL, HOT WATER, SALT WATER, ANTI-FREEZE SOLUTION . . . NONE OF THESE LIQUIDS WILL MAKE A FILM OF FORM-A-GASKET MOVE FROM POSITION, MELT OR DISSOLVE!

Permatex Form-A-Gasket used in automobile and aircraft engines is available in three types.

FORM-A-GASKET NUMBER 1 IS A PASTE THAT DRIES FAST AND SETS HARD.

FORM-A-GASKET NUMBER 2 IS A PASTE THAT DRIES SLOWLY AND REMAINS PLIABLE.

AVIATION FORM-A-GASKET IS A HEAVY LIQUID THAT SETS QUICKLY AND DOES NOT DRY.

These three Form-A-Gasket products are used in many industries wherever leakproof, pressure-tight flange unions, gasket assemblies or screw thread connections are required.

PERMATEX COMPANY, INC.
Sheepshead Bay, N.Y., U.S.A.

The Job Is Being Done

(*Continued from page* 27)

degree circle. This naturally increases the tank's effectiveness in action.

The changeover to the all-welded tank is being accomplished with less disturbance than is normally caused in the annual change of automobile models. The master mechanics of the first arsenal, having helped their former competitors through a sharing of experiences, are, in turn, being helped by the very men whom they taught. The closest of cooperation is being maintained between these peacetime rivals.

The excellent progress made on the tank assignments is due, in part, to the automotive industry's ability to overcome shortages of special machine tools. Unable to obtain many of the larger sized tools, several firms built their own in record time.

One company, for example, took on a government order for giant planers needed in tank work. Starting with a small order, this company completed the first planer in two months, as compared to the usual time of six months required to build one. The contract has since been increased, until this company is now supplying planers to many war contractors. Another company adopted a flame-cutting process to form the steel sprockets which transfer the engine's power to the caterpillar track. This method allows 12 sprockets to be turned out every six minutes. About eight hours were formerly required to make only one.

With the supply of vertical boring mills completely exhausted, another company, receiving an order for tanks, decided to build its own. Progress was so rapid that the company not only filled its own needs, but has since supplied vertical boring mills to other factories producing tanks.

Fifteen spring and bumper companies, by pooling their facilities have contracted to produce $25,000,000 of armor plate a month, sorely needed in the nation's expanded tank program.

New and ingenious methods of preparing tanks for shipment on flat cars have saved many hours of time and have greatly eased shortage of shipping facilities. Forty-foot flat cars, for example, were previously capable of carrying only one tank, due to the extensive crating used to secure the tanks. Inasmuch as the load capacity of most of these cars was capable of carrying two tanks, one company sought ways and means of conserving space.

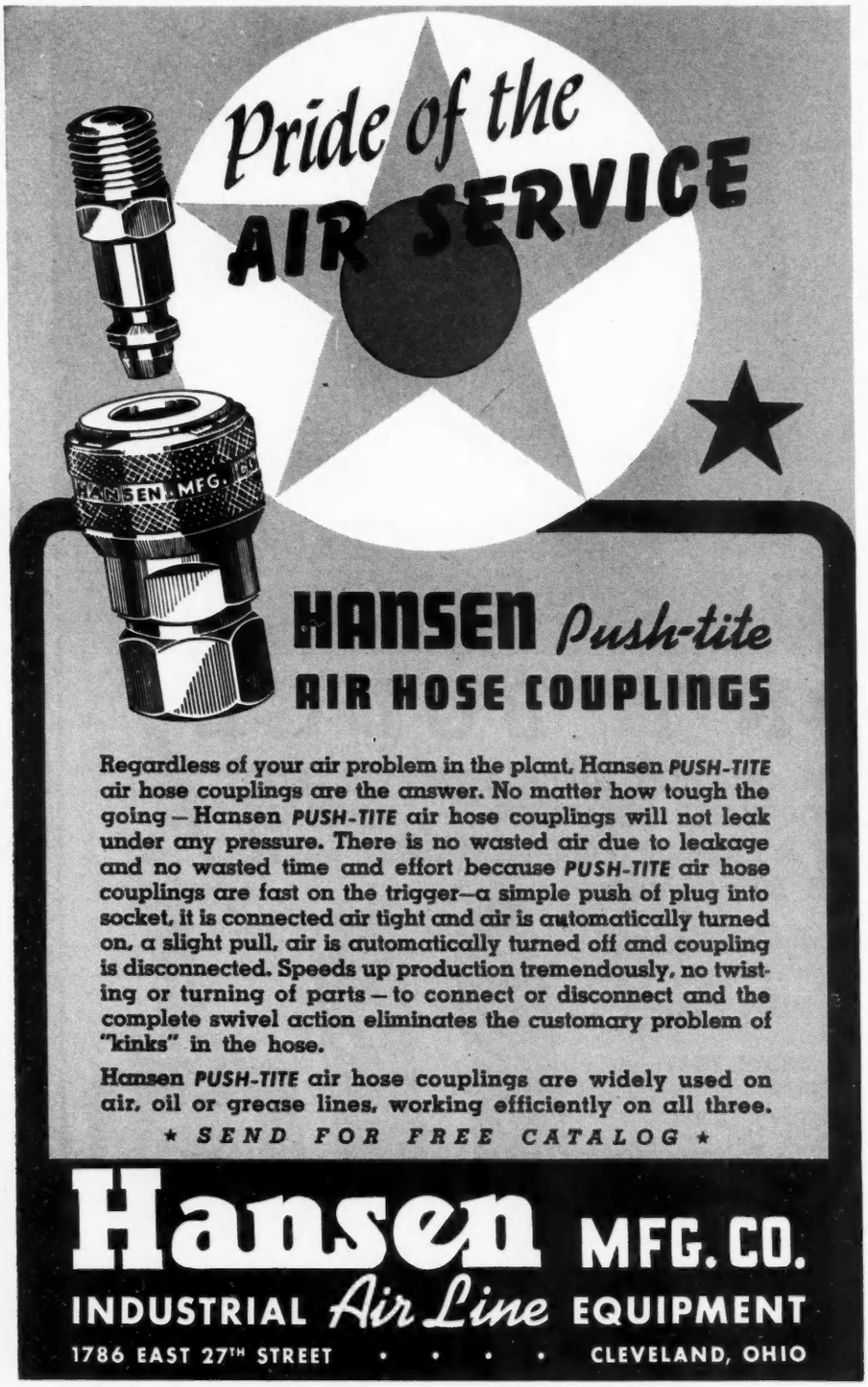
By redesigning the blocks which anchor tanks in shipment, this company eliminated sufficient dunnage on each end to enable it to load two tanks on each car. Other innovations enable two men to load a freight car in less than two hours. Previously it took four men approximately eight hours.

Super-marine engines, each developing more than 1300 horsepower, have been rolling off one company's assembly lines for the past three years. Refined descendants of the famous Liberty engine, these units supply the power for the U. S. Navy's PT boats. Since the first order, this company has doubled and redoubled production on these 12-cylinder V-type engines, to keep pace with expanded needs.

Another automotive company is making more than half the Diesel engines the U. S. Navy uses. This plant, which has been building Diesels for the U. S. Navy for the past nine years farms out work to 250 sub-contractors. Recently it undertook the construction of 10,000-ton cargo freighters, engaging four shipyards as sub-contractors on the job.

America's blueprint for victory calls for the dominance of air power in the all-pervasive ocean of the planet's atmosphere.

In the launching of this mighty armada, the automotive industry has a vitally important role. Already, seven former manufacturers of automobiles are producing airplane motors. Two others are tooling plants for similar work. Of the seven in production, one has been supplying all the engines for


Pride of the
AIR SERVICE
HANSEN MFG.
HANSEN Push-tite
AIR HOSE COUPLINGS
Regardless of your air problem in the plant, Hansen PUSH-TITE air hose couplings are the answer. No matter how tough the going — Hansen PUSH-TITE air hose couplings will not leak under any pressure. There is no wasted air due to leakage and no wasted time and effort because PUSH-TITE air hose couplings are fast on the trigger—a simple push of plug into socket, it is connected air tight and air is automatically turned on, a slight pull, air is automatically turned off and coupling is disconnected. Speeds up production tremendously, no twisting or turning of parts — to connect or disconnect and the complete swivel action eliminates the customary problem of "kinks" in the hose.
Hansen PUSH-TITE air hose couplings are widely used on air, oil or grease lines, working efficiently on all three.
★ SEND FOR FREE CATALOG ★
Hansen MFG. CO.
INDUSTRIAL Air Line EQUIPMENT
1786 EAST 27TH STREET • • • • CLEVELAND, OHIO

How to care for and handle
DU PONT "LUCITE"

Information for aircraft manufacturers and their established enclosure suppliers...

THE quality of a finished enclosure made from Du Pont "Lucite" methyl methacrylate resin sheeting will depend largely on the care used in handling—from the time it is received until it has been fabricated and mounted in the completed aircraft.

"Lucite" sheets are made with a brilliant surface finish. If the surface is marred, transparency is reduced. No known commercial method of surface refinishing can restore original surface luster and transparency. "Lucite" can be scratched by materials that mar aluminum.

MASKING: To protect the surface of "Lucite" sheets from dirt, grit and abrasion during shipping, storing and fabricating, both sides are covered with 50-lb. kraft paper, attached by a rubber cement. This masking complies with government specifications for acrylic resins.

If necessary to remove paper for inspection, precision machining or forming, just loosen one corner with a fingernail, withdraw one edge, and roll the sheet off in the form of a tube. Particles of rubber cement are easily rubbed off with a finger —or washed off with hexane, methanol, or warm, clean water.

"Lucite" sheets should not be left unprotected, even when carefully handled. The quickest and cheapest method to avoid minor blemishes is to roll the original masking paper back on—if it is still clean and grit-free. The paper should be kept smooth as it is rolled out, so as to prevent air bubbles between plastic and paper.

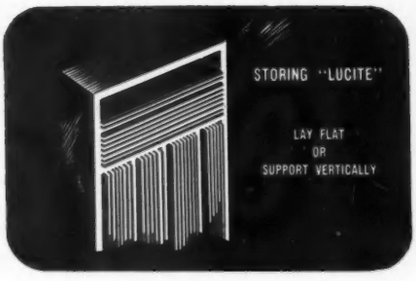
You can use good grade, tough kraft for fresh masking paper. The adhesive should be a rubber solution free of harmful solvents. If you have no suitable adhesive, tape a good quality paper to the plastic sheeting.

UNPACKING: The Du Pont plant ships masked "Lucite" sheeting firmly packed in steel-strapped wooden cases. Remove the packing and lift out the sheets. Don't pry out sheets with chisels or other tools. This will mar the surface. Make sure that nails in the case cover do not scratch the surface. Do not rest the plastic on, or lean it against, sharp hard objects.

STORING: You can store "Lucite" sheets flat, one on top of another; but always place smaller sheets on top of large. Or you can stack sheets vertically with supports at frequent intervals to prevent buckling.

"Lucite" is a thermoplastic material and will soften under sufficient heat. It should be stored away from unit heaters, heating coils, hot water and steam pipes. Masked "Lucite" should be protected from the sun's rays, which accelerate oxidation of the adhesive and cause it to stick to the plastic.

Most satisfactory for storing "Lucite" is a cool, dry place away from solvent



fumes such as those from paint spray areas. "Lucite" presents no fire hazard, does not ignite easily and burns slowly when lit by direct flame. Shavings and sawdust from "Lucite" burn about like wood.

INSPECTION: It may be necessary to inspect "Lucite" for blemishes resulting from shipping, working and handling. A good inspection set-up is a frame covered with felt, flannel or a similar soft material, and backed up by strong daylight or fluorescent light. Inspectors should wear soft, clean cotton gloves. Sheets should be remasked as soon as practicable after inspection.

Leading aircraft manufacturers are using the clarity, weather-resistance, light weight and strength of "Lucite" in their enclosures. Call upon Du Pont for assistance if you have questions of care, forming, machining, mounting or designing. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.; 5801 So. Broadway, Los Angeles; 350 Fifth Avenue, New York City; 1808 North American Bldg., Chicago; General Motors Building, Detroit.

DU PONT REG. U. S. PAT. OFF. **"LUCITE"** REG. U. S. PAT. OFF.

METHYL METHACRYLATE RESIN

some of the most potent fighter planes now in the hands of the United States forces and their Allies.

Two other automotive companies were in production of aircraft engines at the time of the Pearl Harbor attack. A third, getting into production a few weeks later, was a full year ahead of its schedule by mid-May. Aircraft engines in carload lots are now rolling daily from plants of former motor car companies to warplane assembly plants.

In addition, six automotive companies are building airframes for the Army and the Navy. Several are making complete planes. Others are preparing plants for warplane production.

The goal of one of these factories, now in production, is one complete heavy bomber every hour. When in full production, this plant alone will produce as many heavy bombers as all the factories of the entire Axis are believed able to turn out. Yet it represents the effort of only one of more than 100 automotive companies now at work on the task of arming America with supremacy in air power.

A former truck plant is producing constant-speed propellers for four-motored bombers. A network of automobile body plants — including some wood-working mills which fell idle with the advent of the all-steel motor car body—has been integrated into a series of sub-assembly lines, whose products are airframes for two-motored medium bombers of the kind used in the bombing of Tokyo. A chart of those assembly lines would be a map of the Great Lakes basin and the entire Mississippi Valley embracing plants of scores of sub-contractors.

The decision to augment the growing strength of the American aviation industry with the mass productive power of the automobile industry has provided the nation with the strategical advantage of a broad dispersal of the plants from which the warplanes and their components are emerging. An added source of strength is the upsurge of ingenuity which inevitably follows the meeting of fresh minds and new problems.

One company, with 15 major contracts, reached the end of April with its operations ahead of schedule from 13 to 39 per cent, and with more than 80 per cent of its automotive machine tools and equipment fully converted to war work.

Time Is Telescoped

Naturally, the introduction of problems to minds with fresh viewpoints resulted in new solutions. Amazing short-cuts were developed. Automotive engineers, watching aircraft engines produce wasted horsepower in test cells, devised equipment to trap the wasted effort and turn it into electric energy for use in the factory. Automobile body welders, watching the laborious riveting of plane sections for the first time, suggested welding experiments which, authorized by the Navy and proved effective, were adopted and cut hours into minutes. Aircraft engine parts, formerly ground one at a time and by hand, were grouped into special jigs and automatically ground out 14 at a time. Workmen devised a burring tool to replace hand sanding of drilled duralumin sheets, an ingenious "sticker" to feed rivets into holes automatically, a silent rivet bucking bar, and a device to control the number of blows dealt by a pneumatic hand riveting gun.

Recently one company, taking its second order to produce bomber wings and nacelles, contracted to do the job on the basis of less than 50 per cent of the originally specified man-hours.

On a wing-panel operation, use of automotive-type machines and tools saved 75 per cent of the time previously required—and cut the cost of the wing set by around $1,000.

One major manufacturer of automotive ignition and starting equipment, whose development has grown apace with the aviation industry, has cut costs on one model of a vital engine accessory by 30 per cent as mass output efficiency became possible; two other related products also have been reduced around 30 per cent and a fourth item now costs 44 per cent less. Engine prices in some cases also have been lowered as volume increased and experience accumulated. The same is true

(*Turn to page* 62, *please*)

STRATEGY..

FOR DEFEATING *UNDERINFLATION*

To save tires from destruction by underinflation, it is necessary to quickly detect and repair the causes of slow leaks. First, seal all valves with air-tight Schrader Valve Caps, thereby eliminating tire valves as possible sources of trouble. Then if a tire loses air excessively, you know the leak is in the tube, because a valve sealed with an air-tight cap cannot leak! Thus you have conclusive evidence that a repair job is needed. After you have made the repair keep all tires properly inflated and all valves sealed with air-tight caps.

A. SCHRADER'S SON, BROOKLYN, N. Y.
Division of Scovill Manufacturing Company, Incorporated

Schrader
REG. U.S. PAT. OFF.
VALVE CAPS
ALWAYS REPLACE THEM AFTER INFLATION

All Standard Schrader Valve Caps are built with this doubly reinforced sealing unit. Guaranteed air-tight up to 250 lbs. pressure.

inspiration to even greater effort

PROUDLY now the Army-Navy Star burgee flies over NAMCO plant; proudly, too, every man will wear a lapel button denoting his part in the primary job of getting munitions and equipment to the men at the fighting fronts.

"MORE Output Per Day and More Bonds Per Pay" is the slogan at The National Acme Co. Subscriptions via pay roll deductions alone now exceed $10,000 per week. Photo shows Harry Mack, father of a U. S. Navy volunteer, buying another war bond.

AXIS-BUSTING munitions parts shown below are but a few of many now being made on Acme-Gridley Bar Automatics to exacting U. S. Army and Navy specifications. 42 years of successful experience stand behind today's amazing speed, accuracy and low operating cost of these machines.

SPEED—ever greater speed—but at no sacrifice of accuracy—is today's vital war production demand. And Acme-Gridley Automatics are helping to meet the Nation's need by sustaining accuracy at fastest feeds and highest spindle speeds that modern cutting tools can safely stand.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

★ ★ ★ ★ ★ ★ ★

(*Continued from page* 58)

of other items of aircraft equipment.

Centrifugal casting equipment, developed recently to make automobile pistons in a new way, is now whirling out cylinder barrels for an air-cooled, radial power plant going into swift pursuit ships.

In a factory where accessories were made yesterday, America's planes are now being supplied with millions of spark plugs which are superior to anything produced heretofore. The material employed in their manufacture is as hard as semi-precious jewels. Until the Army seized upon it as means to "Keep 'Em Flying," it was little more than a curiosity in the laboratory where it was perfected.

Off the assembly lines by the thousands, motor vehicles in scores of forms have been rolling in a mounting flood to the nation's armed forces since the winter of 1939. Ranging from quarter-ton reconnaissance cars to 40-ton tank transporters, these vehicles represent the fulfillment of the automobile industry's first task in the re-arming of the United States.

The nation's first call upon the industry was a request to assist in building the motorized divisions of the Army into a mobile striking force without parallel. As in peacetime, when commercial vehicles for every conceivable civilian need were available, the motor car and truck manufacturers, quickly adapting their facilities to the new necessities, supplied equipment for virtually all essential wartime tasks.

The adaptations include: mobile kitchens for the preparation of meals on the move; machine shops on wheels; trucks equipped with earth-borers for installing bridge piers, poles for communication lines, and land mines; mobile field hospital units, liaison headquarters, electric power plants, pigeon lofts, telephone exchanges, and water filtering units; vehicles for transport of bombs and heavy ordnance; cavalry auxiliaries for transportation of horses; trailer-unit pumpers for fighting fires.

The Army has standardized on several different sizes of trucks for transporting troops and materiel, for scouting and reconnaissance, for carrying communication equipment, as ambulances, as prime movers for heavy artillery, as mobile machine gun nests.

Though similar to civilian trucks, the military cars are built considerably heavier in order to meet the most severe conditions. The outstanding departure has been the adoption of all-wheel drive for virtually every size and type of military vehicle. This makes possible ascension of grades of 40 to 50 degrees and travel across terrains that otherwise are impassable.

Other problems of major importance in producing military vehicles, such as service and maintenance in the field, noise suppression for better radio reception, and packing and crating trucks for overseas shipping have been tackled jointly by the truck manufacturers.

Many motor truck companies have launched training programs for service men on proper repair and lubrication of trucks. This is an innovation in war production, inasmuch as all responsibility for materials ordered by the armed forces heretofore ended with delivery of the product. With the Army's master fleet expanded today to several hundred thousand vehicles from the 13,000 in service in 1938, the job of maintaining this rolling stock has been a major activity for companies in the automotive industry.

One company has already in operation 30 schools, in which officers and enlisted men are called into factories and taught the techniques for obtaining peak performance of vehicles in the field. Another company recently expanded its service program to station a factory-trained expert at every important Army camp in the United States.

To meet delivery schedules on the huge number of trucks required, and exceed them in many cases, unprecedented cooperation is taking place between former competitors. A Military Vehicles Division has been established under the direction of the Automotive Council for War Production, through which truck manufacturers interchange pertinent information to speed and improve war production.

(*Turn to page* 64, *please*)

When the SWORD returns to the PLOW

The period of reconstruction that follows the present world conflict will bring new problems to your sales force. Competition, supported by greatly enlarged facilities and enriched with present day experience will be keener than ever before. The product that delivers the most efficient service at the lowest cost will command the market.

For the **ENGINEER**

Practical data on SLEEVE TYPE Bearings covering such topics as design, alloys, lubrication etc. Write for the complete set of data sheets.

When you design your new product . . . start with the bearings. Call in a Johnson engineer. Permit him to show you how Johnson SLEEVE TYPE Bearings will deliver greater performance, long bearing life, smooth, quiet operation . . . all at the lowest possible cost. All of his recommendations will be based on facts, free from prejudice and supported by more than 30 years exclusive bearing experience. There is no obligation.

JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

625 S. MILL STREET • NEW CASTLE, PA.

New, Quick Change-over OF TIMING CONTROL

KEEPS RESISTANCE WELDERS IN ACTION!

With the new Westinghouse Electronic Weld Timer you can change complete timing panel for any of 18 different resistance weld operations —in less than three minutes!

The entire timing panel, for example, is released by a single thumb screw. It has an exclusive swing-out design, with special "hingeless-hinge" and snap-hook chains for easy removal and replacement. All connections to the main transformer panel are made by plug and receptacle. No special wiring is needed.

Cabinet for all controls is standard, but timing panels are available in 18 NEMA types as either:

Automatic Weld Timers—to control timing weld current and electrode operation where synchronous control is not required.

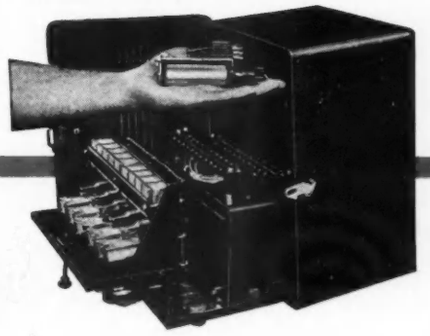
or *Sequence Timers*—to control only sequence of electrode operation where duration of weld current is adjusted by Synchronous Control.

Today's welding production calls for action. Write for Bulletin 3079. It tells you how to increase the adaptability of your resistance welders. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pennsylvania, Department 7-N.

J-21190

PLUG-IN TYPE RELAYS
...replaced in 10 seconds!

A typical example of how the new Westinghouse design speeds maintenance is the special type of plug-in relays. All wiring work is eliminated. Just pull out the old relay, insert a new one—and you're ready to go! Color coded relay base and sockets make identification quick and positive.



Westinghouse

RESISTANCE WELDING CONTROL

Receiving contracts from the War Department for an armored unit, the three companies worked together to standardize the vehicle and make major parts interchangeable. The plan then extended to the purchasing departments and common sources of supply were agreed upon, thus holding tooling requirements of the job to the minimum. Instead of three sets of identical tools, only one was needed, with the cost of the tools shared on a pro-rata basis. The manufacturing and inspection operations then became a part of the pool, thus interlocking all phases of the job.

Throughout the war effort, the optimism of the automotive industry has been based on the knowledge that, once given the signal, miracles of production would crop up on all sides; nobody doubted the ability of the most completely integrated industry in the world. In commenting on the scorching pace set by the erstwhile pleasure-car builders, General Brehon B. Somervell, commanding general of the Army's Services of Supply, said in part:

"The road ahead is dim with the dust of battles still unfought. How long that road is, no one can know. But it is shorter than it would have been had not our enemies misjudged us and themselves. For, when Hitler put this war on wheels he ran it straight down our alley. When he hitched his chariot to an internal combustion he opened up a new battle front—a front that we know well."

British Halifax II Bomber

(*Continued from page* 24)

the propellers and other uses. Messier under-carriages with Dunlop wheels and 24 by 19 in. tires retract into the engine nacelles and are hydraulically operated, with a hand pump in the fuselage for emergency use.

In plan the wings have a pronounced taper, the chords being 16 ft at the root and 6 ft 6 in at the tip. All engines are mounted ahead of the leading edge of the wings, but the inboard pair are slightly farther ahead than the outboard pair, which implies that the propellers of adjacent engines are not in the same plane. Control surfaces are normal, the wing flaps being of the Handley Page slotted variety. The tail plane has a fin and rudder at each end.

In the nose of the fuselage is most of the accommodation for the crew, including the front gunner, bomb aimer and navigator, radio operator, chief pilot and fire-controller. Behind these is the flight engineer's compartment, while, aft again, through a door in an armor-plate bulkhead, are an equipment store and a rest station for the crew. Here are the main fuel tank cocks under the upholstered seats, and controls for releasing the undercarriage from its retracted position if the hydraulic system should fail. In the rest station are also some of the oxygen bottles, connected to 13 points distributed about the fuselage at which the crew can obtain oxygen by plugging into bayonet sockets.

Aft of the compartment just mentioned, and separated from it by a draft-proof wall of plywood, is extensive storage for flares and other items of equipment, and here, too, is a swinging ladder giving access to the dorsal two-gun turret. From this point conveyor rails for ammunition run back to the four-gun rear turret.

An effective heating system for the crew is installed. It consists of special radiators coupled to the cooling system, one above and one behind each inboard engine. Air, under control, is passed through these radiators and led through flexible tubing to the interior of the fuselage, where piping of smaller diameter branches off to the various compartments.

The main bomb ray, 22 feet in length with eight doors, is under the fuselage floor. Six other bomb compartments in the wings for carrying 500-lb bombs are located on each side, between the fuselage and the fuel tank. Developed by Handley Page and the Gyral Gears Co., a special type of winch that has been adopted as standard by the R.A.F. is fitted for bomb loading. It can be operated electrically or by hand.

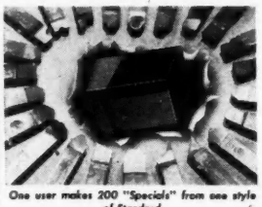
USE THIS METHOD TO GRIND CARBOLOY TOOLS QUICKLY—EASILY—EFFICIENTLY

Correct grinding of Carboloy tools is important! A poor grind wastes carbides, delays vital production and increases costs. A good grind provides long, trouble-free life between tool changes, conserves tools and speeds production.

When established procedure is followed, Carboloy tools can be ground quickly, efficiently and just as easily as ordinary tools. Below are a few of the more important points to observe. Detailed instructions are available upon request. These are contained in a 32-page manual on Carboloy tool design, application, brazing and maintenance.

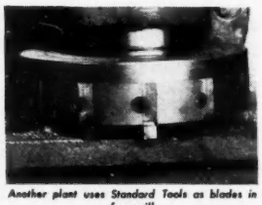
Use Standard Tools for Economy, Flexibility and Prompt Delivery

Carboloy Standard-Stock tools are available in 10 styles, a wide range of sizes and in general purpose grades for steel, cast iron, non-ferrous metals and non-metallics. They are adaptable to 80% of all turning, facing and boring jobs.



One user makes 200 "Specials" from one style of Standard

Many users maintain a stock of these standards in their tool crib and quickly grind to special shapes as required, ready for the job usually in less than one hour. One user (see cut) quickly adapts 200 special shapes from one style of Carboloy standard tool. Another (see cut) uses these standard tools as blades in face mills.



Another plant uses Standard Tools as blades in face mill

For a short cut to speed up—use Carboloy Standard Tools. Catalog GT-140.

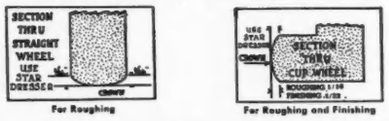
1. Use Correct Grinding Wheels

Use only the soft silicon carbide wheels recommended by wheel manufacturers or your carbide tool supplier. The following wheels are recommended for grinding single-point straight shank Carboloy tools:

	Wheel Specifications Carborundum	Norton
ROUGHING		
Silicon Carbide Wheels (Not recommended in sizes less than 10" dia.)	G-60-R-W	3960/1 I 7
FINISHING		
Silicon Carbide Wheels (Cup)	G-100-S-W	39100/1 H+7
Diamond Wheels (For Carboloy Tip)	100	100
LAPPING		
Diamond Wheels	240 Grit	220 Grit

2. Dress Wheels for Rapid Stock Removal

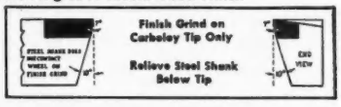
Correct dressing of wheels is important in safely obtaining rapid stock removal. Method shown enables you to keep area of contact against tool at a MINIMUM—avoiding generation of excessive localized heat—an absolute essential when grinding safely and rapidly.



For Roughing — For Roughing and Finishing

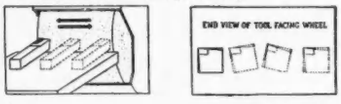
3. Use Double Angles to Insure Good Finish

When rough grinding, ALWAYS grind side and front relief angles 2° to 5° greater than finished angle desired. By this you avoid grinding on the steel shank when finish grinding. Steel loads wheel rapidly—prevents you from obtaining best possible cutting edge. (Use regular abrasive wheel for grinding steel.)



4. Important! Keep Tool Constantly Moving

The following movements prevent excessive localized heating in the Carboloy tip and assure uniform wheel wear: Keep tool moving back and forth across wheel at all times while roughing, finish grinding and lapping. Keep tool ROCKING during roughing and finishing, as shown.



General Hints

If top face needs grinding, always grind it first. Then grind: (1) Front relief; (2) side relief; (3) radius. Complete each cycle for roughing, finishing, lapping.

Use rigid, carbide tool grinders equipped with adjustable table rests and graduated dial to obtain correct angles.

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MECHANICAL AND HYDRAULIC PRESSES

CLEARING

MACHINE CORPORATION

CHICAGO

Scrap Salvage

(*Continued from page* 19)

dling and classifying of A & M material are eight girls who are employed full time for this purpose.

Boeing has demonstrated the efficiency of its salvage program. WPB rates each plant by the percentage of segregation it secures—the amount of its scrap aluminum which can be identified and put to use again—and the higher a company's percentage, the more it is likely to be favored by WPB. Boeing's percentage of 95.38 for March is at the top of the list.

An important contribution to the melting pot at the Boeing factory is an aluminum alloy tubing known technically as 52S, valuable for its magnesium alloy. Strips of sheet metal from the punch presses and brass borings from the lathes go into the collection. Kirksite turnings, produced in making dies for the great presses, are taken to a smelter, where their steel content is removed and returned to the factory in the form of ingots.

Into the Boeing scrap bins go aluminum, stainless steel, and plain steel scrap. Steel and dural borings, or metal shavings, are swept up around the routers and milling machines and sifted through a screen. Other items on the salvage list include clamps, rubber and metal caps for tubing, bolts, nuts, screws, rivets, metal and iron washers, wood, short pieces of insulated copper wire, burlap, rejected pieces of rubber hose and weather stripping. A considerable number of personal tools also are saved. Small stuff, such as caps, nuts, bolts and screws, is returned to the shops. While much of the larger material is sold, aluminum is returned to its producers, where it is remelted and rerolled.

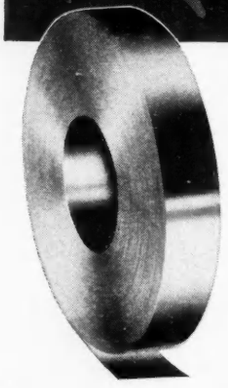
Northrop Aircraft, after trying various methods, realized that it could have success with its scrap segregation program only by bringing the importance of the problem to the man in the shop. This meant that proper segregation of scrap and discarded aluminum generated in his department would be the responsibility of each individual supervisor. To assist the departmental supervisor the salvage and conservation group outlined a definite educational program intended to reeducate the view of the employe regarding a piece of scrap metal.

The standard procedure of providing marked containers for scrap proved efficient except in the machine shop where mixing of aluminum borings and turnings, due to rapid job changes of the various machines, made it impossible to set up any definite method of segregation. The segregation of aluminum borings and turnings became a matter of recovery from machines developing large quantities — the hinge mill, the spar mill, the contour machines. Removable partitions are used to separate these machines from the job machines throughout the shop. Thus, 80 per cent of aluminum borings and turnings are segregated to a fair degree of accuracy, while the balance of 20 per cent is sold as mixed scrap.

Douglas Aircraft Company's material conservation program this year has reduced the percentage of scrap to raw material handled by 12 per cent from 1940, and by 50 per cent from 1939. However, the company's scrap poundage is more than double this year due to greatly increased production.

During 1940 23,000 pounds of rivets, worth $15,000, accidentally dropped to the floor. Re-sorting them on special machines and inspecting them for reuse added 50 per cent to the original cost. High as that total is, it represents a notable decrease of 60 per cent in droppings over the previous twelve months. This improvement was brought about by the cooperation of workmen, and through educational posters and other devices. For example, a new design of aprons and boxes not only saved rivets but reduced by 50 per cent the amount of mixed nuts and bolts that have to be sent out for resorting at a cost of fifty cents a pound.

Douglas has instituted a unique cam-



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★ Close tolerances — super-smooth finish for perfect functioning of parts, while important to other industries, are *vital* throughout the field of aviation.

That's why practically every leading producer of airplanes, the manufacturers of aviation instruments and controls, has adopted Sunnen Precision Honing for sizing and finishing internal cylindrical surfaces from .185" to 2.400" — quickly, accurately, and at a lower cost.

Does Not Require Skilled Labor

Workers in "teens" can handle jobs in "tenths" after a few hours' instruction and practice!

This practical, inexpensive, economical machine can be set up and work located in one minute. Size adjustment can be made while machine is in motion with work on mandrel. When expensive reamers or broaches get a little undersize, many manufacturers remove the last thousandth or so with the Sunnen Precision Hone. Relieves big internal grinders for other jobs.

Corrects errors of out-of-roundness or taper caused by previous operations. Maintains alignment. Facilitates duplication of sizes.

In plant after plant, the Sunnen Precision Hone is showing production increases of 100% to 500% with corresponding savings in costs. For faster, lower-cost honing of small diameters, put Sunnen equipment to work in your plant.

Write for FREE BULLETIN

—giving complete information. Or, if you prefer, a Sales Engineer will call and demonstrate this equipment in your plant on your job.

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SUNNEN

Typical Examples

As you can readily appreciate, we cannot publish detailed information on Sunnen "success stories." However, here are a few general examples of the type of aviation parts being handled on the Sunnen Precision Hone.

Aluminum Aircraft Link "produces high finish without bell-mouthing."

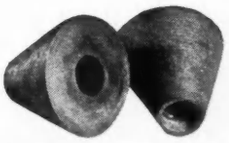
Saved time in producing a smooth, accurate finish on this bronze remote control valve body.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Aircraft Valve Tappet Roller. 4-Micro finish.

"Produced an extremely accurate and glass-like finish."

Airplane Engine Parts accurately honed to a super-smooth finish.



Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Drill Jig Bushing "Increases sales appeal of product."

Hardened Steel Ring Gauge — finished to an accuracy of .000025" for roundness and straightness.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

paign of "Tokio Kid" posters, showing the joy that beams in a Jap's face when rivets are mixed and tools broken in our shops. These posters, in addition to being used as an educational device for Douglas employes, are being sent to subcontractors who supply Douglas's production lines.

After sheet metal and rivets, the next largest scrap items at Douglas are lucite and plexiglas. These are readily reclaimed, and larger pieces are widely in demand by novelty manufacturers who turn them into cigaret boxes and decorative gadgets of all kinds.

By July, according to WPB figures released recently, just the aluminum scrap salvaged by America's aircraft plants will furnish enough aluminum to build 250 Flying Fortresses, and the magnesium reclaimed will build 500,000 incendiary bombs every month.

Rubber Substitutes—Large Scale Production

(*Continued from page* 35)

negotiating with the Government for a contract to produce butadiene. Standard Oil of New Jersey has a process which it obtained from I. G. Farbenindustrie in the deal covering rubber-synthesizing processes. It has turned over the details of the process to the Government, but whether this process will be actually worked is not known at present. The Union Carbide & Carbon Company of New York is reported to own a series of patents covering a process for the production of butadiene from ethyl alcohol and to have received a Government order for 80,000 tons of butadiene.

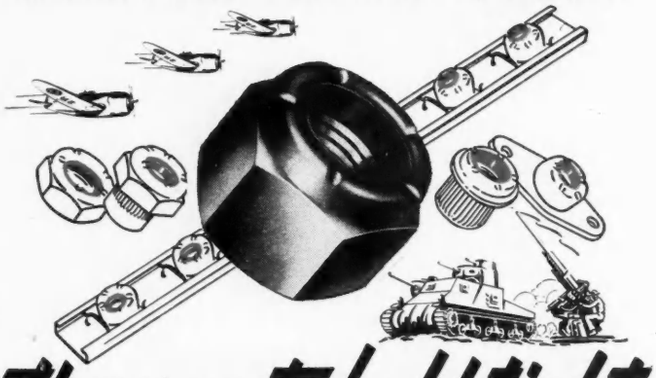
One of the latest developments in this field is a process for producing butadiene from grain without passing through alcohol as an intermediary, which is said to have been evolved by chemists of Distillers Corporation-Seagrams, Ltd., in cooperation with Dr. Donald Kies of the University of Illinois. Under the new process, 2-3 butyl glycol is produced from grain directly and is concerted into butadiene by steps which are said to be simpler and fewer in number than those involved in the production of butadiene from ethyl alcohol.

Contracts for the construction and equipment of four polymerizing plants were given by a Government agency to four of the large rubber companies last summer. These four plants are to have a combined capacity of 3300 tons per month. This is equivalent to about 40,000 tons of rubber per year, and it would appear that under the new program calling for a production of one million tons of synthetic rubber per year, this capacity will have to be multiplied twenty-five-fold.

The above covers only one phase of the production of the needed rubber substitute, and that the simpler and least expensive one—the polymerization process. A greater investment undoubtedly will have to be made in the plant for producing the monomers and incidental materials needed. It is in connection with the production of the monomers that the alcohol conversion process has its greatest appeal, for all or nearly all existing distilleries can be made available for the production of "military" alcohol, that is, alcohol intended for the production of smokeless powder and for the production of rubber substitutes. According to one report all, and according to another all except 10 per cent of the existing beverage distilling capacity of the country has been switched over to the production of alcohol for other uses. This gives the country a total production capacity of 540 million gallons of alcohol per year, and of this 200 million gallons is to be made available for rubber production.

Plants for the production of butadiene from refinery gases will have to be built specially for the most part, and new plant will be required also for the production of the catalyst (sodium) required for the polymerization process, of emulsifying agents and stabilizers.

WHEN THE BIG TEST COMES



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Rationing and the Passenger Car Stockpile

(*Continued from page* 41)

difficult or impossible to buy a car. I am going to try to make my ancient chariot last—if it falls to pieces, I will go to work on the street car or the bus. I am not very much concerned with the individual who wants to buy a car for the sake of taking his best girl out for a drive. If he can find a buggy, I suggest that he do so as my father did when he was courting my mother."

Enumerating some of the essential classifications, Mr. Henderson continued: "I grant you that there are many other classifications who in their own minds are important. The acid test, however, for this is whether or not the individuals or groups of individuals who may share a vehicle are engaged in work essential to the winning of the war. If this is not true, I submit that the individuals or the group must make a sacrifice in the interest of winning the war. If it is essential, then that individual or that group must be allowed to buy a new car or truck."

Indubitably, most dealers comprehend the tone of Mr. Henderson's remarks. But perhaps some are still reluctant to admit that the eligible classifications are sufficiently broad. Nevertheless, it is definitely true that most dealers feel the restrictions placed on the eligible buyers are somewhat severe. It remains to be seen whether recent changes in the rationing rules will have a salutary effect on sales.

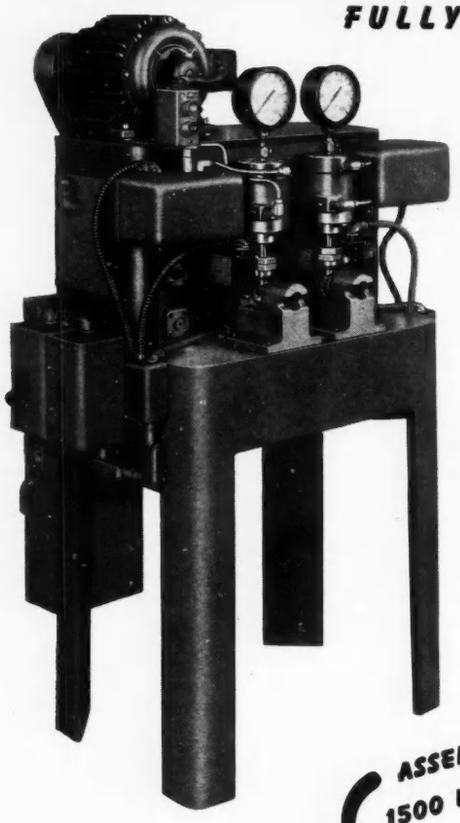
By the end of March, 41,000 new passenger cars had been released by local rationing boards. Of this total, however, 24,000 were cars bought before Jan. 1, 1942. Thus, counting out 2000 vehicles made available to state and local governments through non-quota certificates, about 15,000 cars chargeable to the March quota were released for sale by the rationing boards. Although complete figures are not available, it appears reasonable to conclude from well founded reports that certificates have been issued to cover about 75 per cent of the applications received. Figures showing the total sales for March, April, and May have not been released. It is evident from the complaints of dealers, however, that a large percentage of the 120,000 listed for sale within the period ending May 31 are still in dealers' hands. There is, too, a surprising spread between the number of certificates issued and the number of cars sold[1].

Why aren't dealers disposing of their new cars at a rate commensurate with the quota set up by the OPA? The answers to this question, vital to dealers who would like to stay in business, are just about as numerous as the people who think they have an answer. But, taking the testimony of men charged with dealer welfare, there are several basic reasons for dealer inactivity and the apathy of the public.

Mr. Henderson's allusion to the future confiscation of cars is given as one solution. Others say that the prospects of universally strict gasoline rationing have tempered the thoughts of the buying public. World conditions in general, the rubber shortage, the public's assumption that it's unpatriotic to buy, the severity of some rationing boards, and the lack of dealer effort to sell have all been offered as reasons for the marked drop in buying activity. In fact, many dealers feel that sales would

[1] There is a slight discrepancy here, if one considers a breakdown sent out by OPA on May 30. Noting a "sharp pick-up in the number of applications and in the issuance of rationing certificates for new passenger automobiles in April as compared with March," the OPA concludes that approximately 29,600 cars were released during April. Adding this figure to the 28,000 bought before January 1 and the 17,059 released during March gives a grand total of 74,659 for the period ending April 30. Based on a projection of the reports from 31 states, total applications for April totalled about 39,800, against 22,604 for March. No explanation is given for the absence of many state reports.

SOLDER TESTING MACHINE
FOR 37 MM. A. P. SHOT ASSEMBLIES



FULLY AUTOMATIC CYCLE
CHECKS SOLDER
JOINTS QUICKLY
AND ACCURATELY

When a shot-and-cap assembly is placed in the fixture, it trips a switch which starts the automatic cycle. A hydraulically-operated ram descends against the cap. Pressure is relieved at 1500 lbs. and the ram returns to starting position. The machine shown has two independent units, each complete with hydraulic circuit, relief valve, and cycle controls. A 1 h.p. motor drives the common hydraulic pump. Time of one cycle is approximately 2½ seconds and average production is 800 to 900 pieces per hour.

We specialize in the design and manufacture of distinctive production machinery and are seeking opportunities to help you obtain greater production at lower unit cost.

The cap is assembled to the shot with a wiped solder joint. To meet specifications, this joint must withstand a lateral pressure of 1500 lbs. applied against the threaded portion of the cap.

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not increase if all restrictions were removed.

The general assumption that shortages make it imperative for the public to pass up thoughts of buying new cars seems somewhat shallow and ill-conceived, if one remembers that it is the avowed purpose of the Government to allow the sale of automobiles to persons who need them in carrying on essential activities. Will not these same persons be shown a greater consideration with respect to gasoline and tire rationing? Will they not attempt to replace their cars when the need arises? There's probably a more acceptable reason for this apparent "reluctance to buy."

Around the turn of the century, a reader of *The Horseless Age* made the statement in a letter to the editor that he could consider himself lucky, indeed so very fortunate, when he could take a 100-mile trip without stopping to make repairs. Perhaps this statement gives us a clue. Modern cars, unfortunately for the dealers, don't fall to pieces over night, and, since a high percentage of the owners on the eligible lists are the very ones who own the newer cars, there seems to be little chance of replacing a vehicle that simply isn't worn out[2].

Now from the dealers' point of view, this type of reasoning is totally uncalled for. He was, originally, in business to sell cars; he'd like to think that he still is. The eligibility list to him is a classification of persons to whom he can *sell* cars. To the Government this list represents persons *eligible to buy* cars when the need arises. Obviously, this differentiation is of vital importance.

Although the Government has modified within the past few weeks the restrictions on the sale of new cars, it is always to be remembered that, modified or not, the restrictions as they stand apply to the same group of eligible buyers. The Government has merely made it easier for the people on the original list to buy an automobile. Said Mr. Henderson recently:

"The present amendment to the new Automobile Rationing Regulations results from reports received recently from state rationing administrators which indicate that new passenger automobiles are now moving at about 40 per cent of the quota rate. By relaxing the age and mileage requirements for trade-ins, and by establishing relatively liberal tests of need, this amendment undoubtedly will increase the flow of cars into the hands of eligible buyers.

"There are, however, other factors which have held up the movement of automobiles. Some eligible persons who need to replace their cars are not doing so because they believe it to be unpatriotic.

"To such people, I would like to say that there is nothing unpatriotic about replacing a car which is used to perform essential services and which would have to be replaced next year or the year after. To the extent that we can equip those who need automobiles for the performance of essential services with the best available transportation, we will be cutting costs of storage and reducing next year's automobile requirements. Those who obtain new automobiles under the rationing program have, however, a special responsibility for using their cars sparingly, for driving slowly and carefully, and for keeping their automobiles and tires in the best condition possible."

Although the immediate problem of most dealers is either to sell cars on hand or to get real financial assistance, the difficulties created by long storage cannot be left unconsidered. At the outset of the rationing program, many believed that the allotment for 1942 would be sold. But now, with only a fraction of the cars allotted for sale within the period ending May 31 actually sold, there is reason to believe that many more cars will be in

[2] In a recent pamphlet entitled *Automobile Transportation in the War Effort*, published by the Brookings Institution, the author, Charles L. Dearing, stresses the need of workers and rural residents for passenger car replacements. If this need exists, then the percentage of eligible buyers owning older cars must be higher, since statistics show that these groups own a large percentage of the older cars, automobiles with a shorter life expectancy. These same buyers, however, draw heavily on the *used* car market.

Specialists in
OILPROOF
ANTI-CORROSIVE
WRAPPINGS
As the largest manufacturer of specialty packaging papers, we have long made anti-corrosive and oilproof wrappings for annular bearings and small machine parts.
Recently, at the request of firms in the aviation industry, we perfected a complete line of special anti-corrosive wrappings for the protection and long-term storage of all metal products.
These papers have proven anti-corrosive properties, combined with oilproofness, strength, pliability and moisture-vapor-proofness. They can be "tailor-made" to your specifications if necessary.
Write for Samples and Technical Bulletin No. 82
RIEGEL PAPER CORPORATION
342 MADISON AVENUE, NEW YORK, N. Y.
65

ZINC IN WAR

PROTECTING THE MERCHANT MARINE

The United States must not only out-produce our enemies, we must see to it that this matériel reaches the far flung fighting fronts. To this end America has dedicated itself to the most gigantic ship building program in all history—and these vessels must be made as efficient as humanly possible for the courageous men who sail them.

Zinc plays an important role in protecting metal surfaces, and thus protecting men at sea. Working metal parts on ships can easily be fouled by rust. To insure efficient operation when emergencies demand quick action, such important parts as life-boat davits, shown above, are sprayed with protective zinc coatings. The corrosion-inhibiting properties of galvanized (zinc coated) iron or steel are well known —and sprayed zinc dust provides this same measure of protection for metal surfaces which do not lend themselves to galvanizing.

The photographs in the background of this advertisement show: (1)—left to right—Cast iron sheaves for life-boat davits before finishing, after grit blasting and after spraying. (2) Stacks of completely finished sheaves. (3) Grit blasting the sheaves and (4) Spraying them with zinc dust using a special gun.

Other important uses for sprayed zinc include marine floats, airplane pontoons and canal gates. The needs of the Navy and Merchant Marine for sprayed zinc coatings are just additional reasons why civilian users of zinc may not be able to obtain all of the metal or pigment they would like to use.

THE NEW JERSEY ZINC COMPANY

MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS

8 METAL SPRAYING
GALVANIZING
NICKEL SILVER
1 HULL PLATES
2 RUBBER
3 PAINT
4 BRASS
5 CERAMICS
6 DIE CASTING
7 PHARMACEUTICALS

1

2

3

4

storage a year from now. What will happen to cars stored in open lots, for instance, is anybody's guess. The predictions are many and varied.

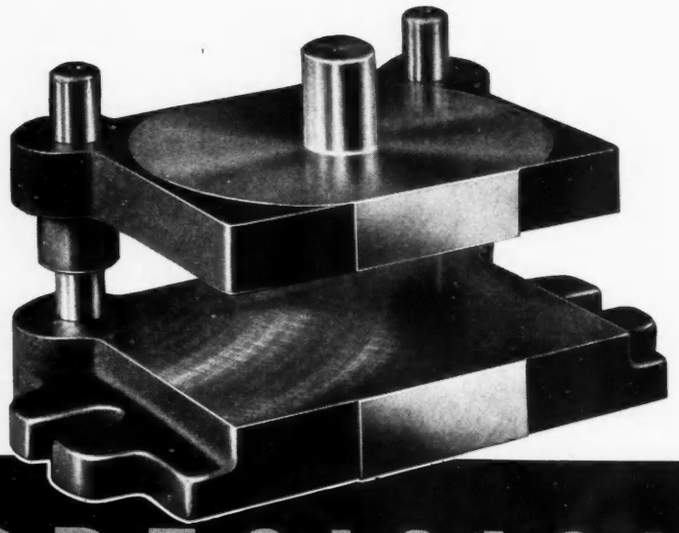
One executive of a large dealer organization has stated that by masking out the windows to prevent fading of the upholstery and by covering the brightwork with a preservative, the lot-stored car will retain its pristine beauty for months to come. Has an automobile ever run on its looks? For some reason the gentleman failed to consider tire deterioration, the effects of temperature variation, corrosion, etc. On the other hand, manufacturers' bulletins describing the preparation of cars for storage outline a day's work for a good mechanic. Of course, before going into this matter too deeply, it would seem advisable to determine how this vast pool of cars is being stored. No one really knows. Indeed one wonders whether the average dealer is in any way disturbed over the problems of storage.

While manufacturers pondered storage problems, dealer organizations stressed dealer relief. And thus, largely through the efforts of the NADA, the recently signed Murray-Patman bill was carried through the Congress. Allowing dealers to borrow up to cost plus one per cent on new cars, and providing for their cost-plus sale to RFC immediately, if the dealer desires to sell, the bill guarantees full retail prices if the cars are unsold on July 1, 1943. This is indeed a bonanza for dealers in severe financial straits; and apparently most dealers are, for some investigators have stated that finance companies have an interest in approximately 90 per cent of the cars. Surely no dealer looks forward to forfeiting his right to make a profitable sale by releasing his stock to a finance company[3].

Now that financial aid is assured, dealers may turn to puzzling about the eventual disposal of their stocks. Any utterance by OPA officials in so far as it affects the ultimate fate of the dealer should merit consideration. Recently, before 500 Detroit dealers, Dr. Rolf Nugent, chief of the Automobile Rationing Section of OPA, maintained that tire and gasoline rationing would effect no permanent impairment to the automobile market. In addition, he intimated that it might be necessary to liberalize the rationing order if the 400,000 scheduled for rationing this year were not sold. He declared that workers in Defense Plants Corporation plants alone would need 50,000 cars this year, and that the Army foresees the need for another 50,000 cars for war workers in plants not covered in the DPC estimate. Furthermore, according to Doctor Nugent, the Army will require an undisclosed number of cars for military use.

And so, as the speculation continues, one can be reasonably sure that (1) the Government will guard jealously its right to the disposition of a half million cars, that (2) dealers will receive financial assistance, and that (3) the methods whereby these cars will be rationed may be changed drastically in the future.

[3] Recent reports show that some larger dealers, banking on RFC support, are buying out the smaller dealers. In a sense, this helps both parties. The larger dealer, with a greater stock, has in his hands greater potential profits. The smaller dealer, although he may have to retire from business, is thus enabled to convert his stock into cash.



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IS THE KNOWN QUANTITY
OF DEPENDABLE ACCURACY
THAT SAVES MONEY IN
DIE MAKING—AND
STAMPING PRODUCTION

WRITE YOUR DANLY BRANCH
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1549 Temple Avenue, Detroit, Mich.
16 Commercial Street, Rochester, N. Y.
1550 E. 33rd Street, Cleveland, Ohio
3913 North Broad St., Philadelphia, Penna.
Ducommun Metals & Supply Company, Los Angeles, Calif.; San Francisco, Calif.

DANLY DIE SETS and DIE MAKERS' SUPPLIES

BOOKS . . .

PROFITABLE PUBLICITY, *by Henry F. Woods, Jr. Published by Dorset House, Inc., New York.*

This book is designed to provide a thorough knowledge of the basic and essential factors necessary to effective and successful work in publicity. It has been prepared along practical lines, describing the technique and methods of publicity, with many examples to illustrate different kinds of publicity, how to do it intelligently, and how to get the publicity published. All this information is presented in a clear-cut, simple, non-technical manner. The book is intended to guide publicity men who are now working in the profession, to help students of publicity who may enter the field, and for business men who may find it necessary to publicize their organizations but cannot avail themselves of the services of trained publicity directors.

» 2 Great Strides Ahead for Production «

BLACK LIGHT *Inspection*

MAGNAFLUX *Announces*

MAGNAGLO
(PATENTED)

Fluorescence under black light brings a new high visibility to flaw indications in magnetic metals by Magnaflux methods. A tremendous gain in contrast is registered compared with Industry's familiar picture of Magnaflux inspections under visible light.

Developed and patented under the name "Magnaglo" this supplementary method produces fluorescent patterns against an unhighlighted background. Smaller indications are more readily seen. Speed of inspection is stepped up by the neon-like glow of quenching cracks, forging laps, non-metallic inclusions, bursts, etc.

ZYGLO
(PATENTED)

Fluorescent indications on *non-magnetic* parts are achieved by another astonishing Magnaflux development—the Zyglo method. Application of a highly fluorescent penetrating liquid to the test surface brings out, after removal of excess liquid, vivid glowing indications of discontinuities under black light. The entire field of non-ferrous materials is opened up to Zyglo inspections. It permits the location of flaws in aluminum, magnesium, bronze, and austenitic steels—all playing a vital part in today's production, all subject to vast improvements in use when flaws are detectable by speedy routine inspection methods.

Correspondence on applications is invited

MAGNAFLUX CORPORATION • 5904 NORTHWEST HIGHWAY • CHICAGO
NEW YORK • DETROIT • LOS ANGELES

MEN and MACHINES

(*Continued from page* 44)

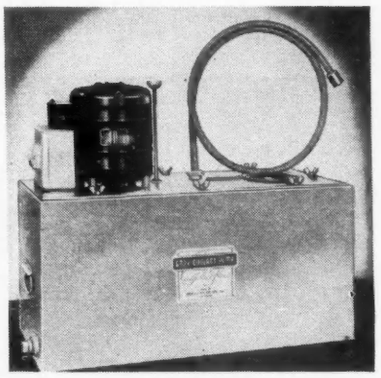
are miscible with petroleum products and are of special value for use where a dry film of graphite is desired, since the carrier is easily and quickly evaporated. They are thus particularly suitable for lubrication of mechanisms operating at high temperatures or where permanent or semi-permanent lubrication is to be provided by the colloidal graphite.

The carrier has an endpoint of 400 F, thus being superior to kerosene type dispersions with respect to rate of evaporation. Non-toxic, the dispersions are available as concentrates.

The dispersions make possible the application of "dry" films of colloidal graphite to surfaces by spraying, dipping, brushing, or other methods. Under friction and elevated temperature such films provide a "slick" graphoid surface on the parts so treated.

Stabilized high-purity electric-furnace graphite is used in the new standard dispersions as in other Acheson Colloids products.

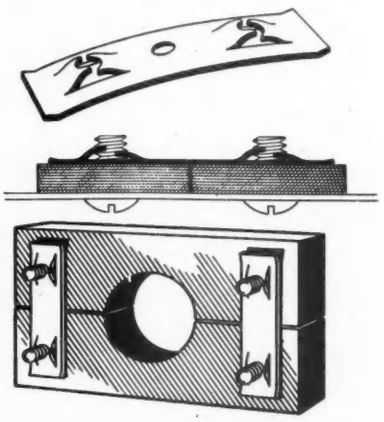
THREE new Gray coolant pumps, models G-2A, G-3A, and G-4A, are designed for the automatic application of coolants to cutting tools. Built by the Gray-Mills Co., Chicago, Ill., the pumps feature controlled flow from a few



Built by the Gray-Mills Co., Chicago, Ill., this coolant pump is available in three sizes providing rates of flow from 75 to 165 gallons per hour.

drops to a full stream, ball-bearing motors, and a forced settling fixture to keep coolant fluids clean. Standard working tables may be adapted to the pumps by using fittings manufactured by the Gray-Mills Co.

NEW "TWIN-TYPE" Speed Nuts, manufactured by Tinnerman Products Inc., Cleveland, Ohio, have been designed to reduce both weight and assembly time for the attachment of fair-lead guide blocks. Only a screwdriver is needed for their as-



New "Twin-Type" Speed Nuts for the attachment of fair-lead guide blocks.

sembly. This new product is designed for use on many other attachments throughout the plane where fastening points are grouped in pairs.

Manufactured with or without a cen-

(*Turn to page* 80, *please*)

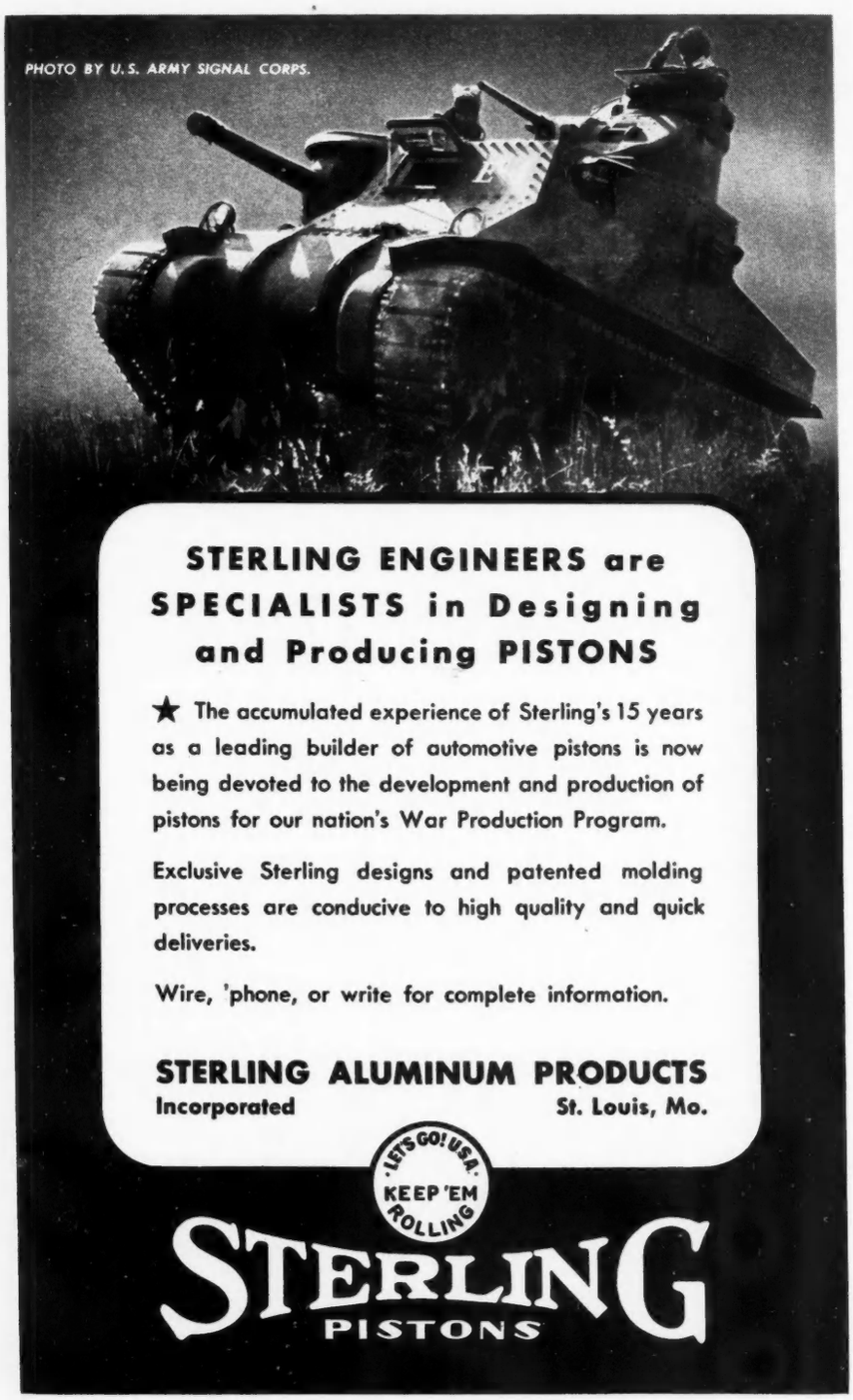
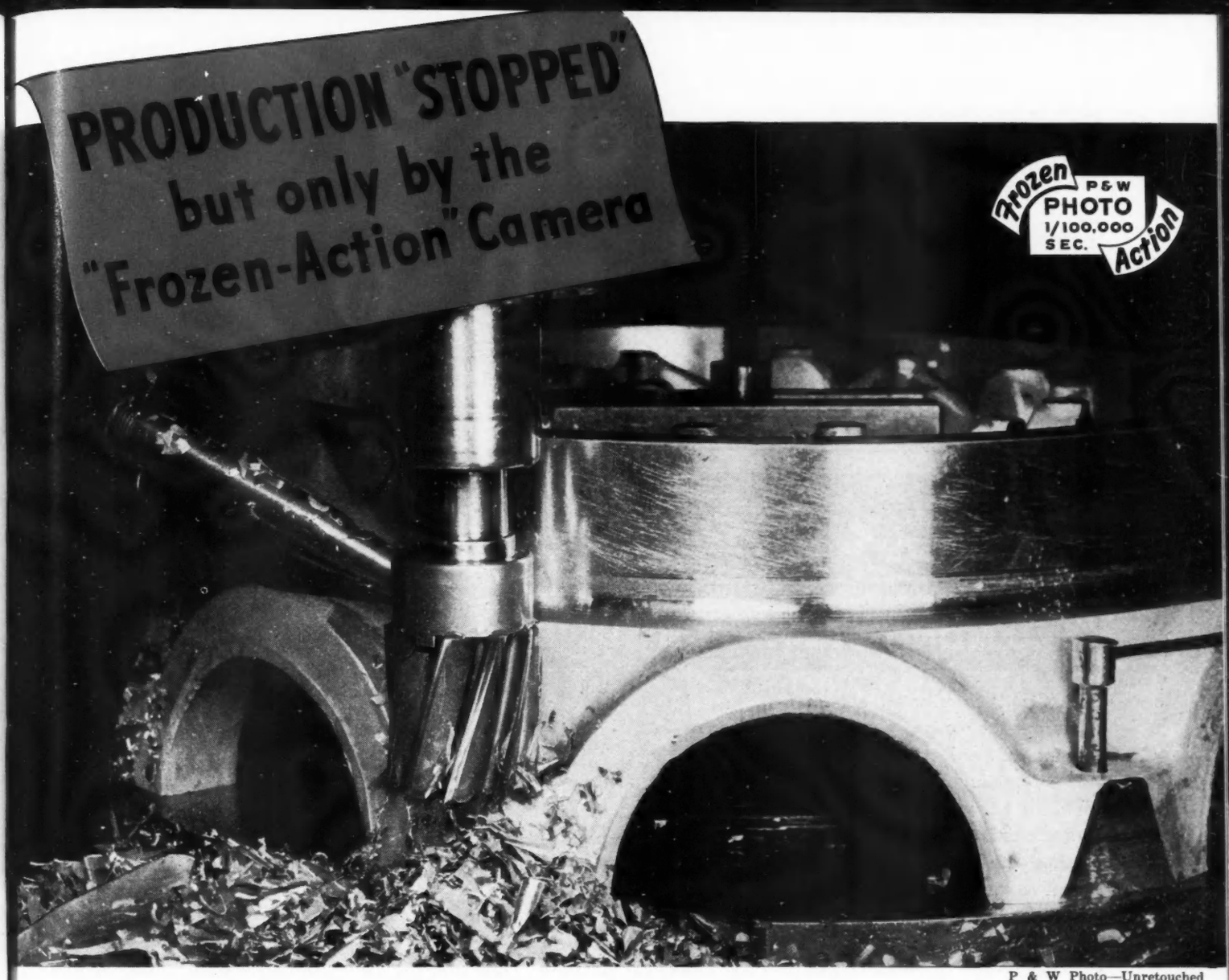


PHOTO BY U.S. ARMY SIGNAL CORPS.
STERLING ENGINEERS are SPECIALISTS in Designing and Producing PISTONS
★ The accumulated experience of Sterling's 15 years as a leading builder of automotive pistons is now being devoted to the development and production of pistons for our nation's War Production Program.
Exclusive Sterling designs and patented molding processes are conducive to high quality and quick deliveries.
Wire, 'phone, or write for complete information.
STERLING ALUMINUM PRODUCTS
Incorporated
St. Louis, Mo.
LET'S GO! U.S.A. KEEP 'EM ROLLING
STERLING
PISTONS



P & W Photo—Unretouched

STANDING still? Not *this* milling cutter, mister! Twenty-four hours a day, *every* day, it's scooping big chips out of crankcases that are about to chase little yellow sons of Nippon right out of the sky. There are American aircraft engines being built — and *fast*, mister!

P&W cutting tools — reamers, taps, dies, end mills — are in there pitching, rapidly, *accurately* . . . consistently delivering *extra* cuts per grind.

The photo? No standstill pose that, but shot on the job at 1/100,000 sec., to show you just a sample of the hundreds of kinds of P&W precision tools now building American war strength in top-speed 3-shift production.

Don't spare the pressure. Your P&W tools can take it.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

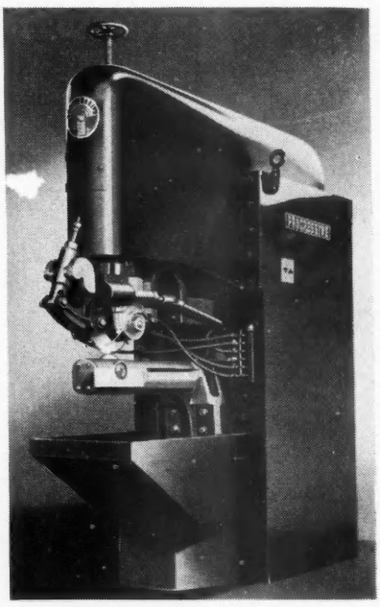
WEST HARTFORD • CONNECTICUT

ter hole, the nuts are made in the following sizes which indicate distance from center to center of screw holes: ½ in., ⅝ in., ¾ in., ⅞ in., and 1 in., for use with either AN 515-6 and -8 screws, or Air Corps 530-6 and -8 screws. The only information required from the aircraft manufacturer is the screw size, spacing from center to center of holes, and whether the nuts are to be furnished with or without rivet holes.

A COMPLETE line of seam welders, furnished in three capacity ranges and 126 models, has been announced by the Progressive Welder Co., Detroit, Mich.

In each of the light-, medium-, and heavy-duty series, several standard throat depths are available; each type is also supplied in six different standard drives, three for circular-, and three for straight-seam welding. The Universal model, which may be used for both straight and circular welding, is also available in three drive types and three capacity ranges. The welders are designed for either interrupted or continuous seam-welding.

These machines are designed for use with standard RWMA welding wheels, which can be readily adapted to individual applications. They are externally water-cooled. Transformers are available for supply voltages of 220, 440, or 550 volts, and are all of the heavy-duty type with shell-type cores and pancake coils. Standard model seam welders are designed for 50-60 cycle supply, although special modifications make them adaptable for use with other frequencies.



Progressive seam welder.

THE PROBLEM of brazing a ¾-in. threaded flange into a completely closed 20-gage sheet steel container was recently solved by the Induction Heating Corporation, New York, N. Y. Employing a Model 1070 Thermonic Induction Generator, the set-up permits the simultaneous brazing of three units in 35 secs. A ring of silver alloy is melted and flowed to form a perfect, air-tight joint which is said to be as strong as the original metal, if not stronger.

Other new developments are briefly described in the following paragraphs:

New "C" Clamp

New "C" clamp equipped with bronze-bushed screw-tip prevents galling and provides a free movement so that slippage on work is prevented. Manufactured by Patterson-Ballagh Corp., Los Angeles, Cal.

No-Splash Wheel Guard

Newly-designed wheel guard for Hammond carbide tool grinders prevents loss of coolant. Built by Hammond Machinery Builders, Kalamazoo, Mich.

Transparent Metal Finish

"Platelustre" when applied to metals

PERM-A-CLOR always First
AMONG DEGREASING SOLVENTS

Stabilized chlorinated solvents for metal cleaning were originated by the Detroit Rex Products Company. Perm-A-Clor was introduced when it was first recognized that degreasing required the use of highly stabilized solvent. No other solvent has ever equaled it.

Perm-A-Clor is much more stable, both as a liquid and as a vapor, than ordinary solvents.

Triad, another Detrex solvent, is identical to Perm-A-Clor except in the kind and amount of stabilizer. War conditions create many new problems for all of us, but despite these obstacles, our chemical research is creating or finding new and even improved stabilizing materials, so that our products can be marketed without increase in price.

Select the one best suited to your needs.

Safe, Efficient, Low Cost Cleaning With Any Degreaser

SOLVENT DEGREASING and ALKALI CLEANING
DETROIT REX PRODUCTS COMPANY
13001 HILLVIEW AVENUE • DETROIT, MICHIGAN
Branch Offices In Principal Cities of U. S. A.—In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario

simulates copper, brass, bronze, and other metals. Manufactured by Maas & Waldstein Co., Newark, N. J.

Tank Sealing Compound

Zinc chromate sealing compound, highly resistant to aromatic fuels, is furnished in rolls from ⅝ to 2 in. wide and 150 ft. long. Produced by the Presstite Engineering Co., St. Louis, Mo.

Non-Magnetic Bearings

Non-magnetic instrument bearings resist the effects of salt spray and other mild corrosives. Offered by Minature Precision Bearings, Keene, N. H.

Finger Guard

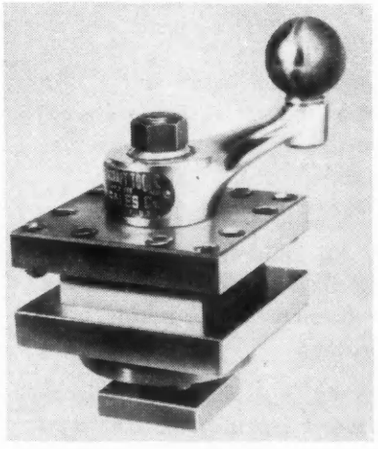
New Steel-Grip Triplex Guard for machine operators protects thumb and first two fingers. Manufactured by Industrial Gloves Co., Danville, Ill.

J. W. DeBeaubien

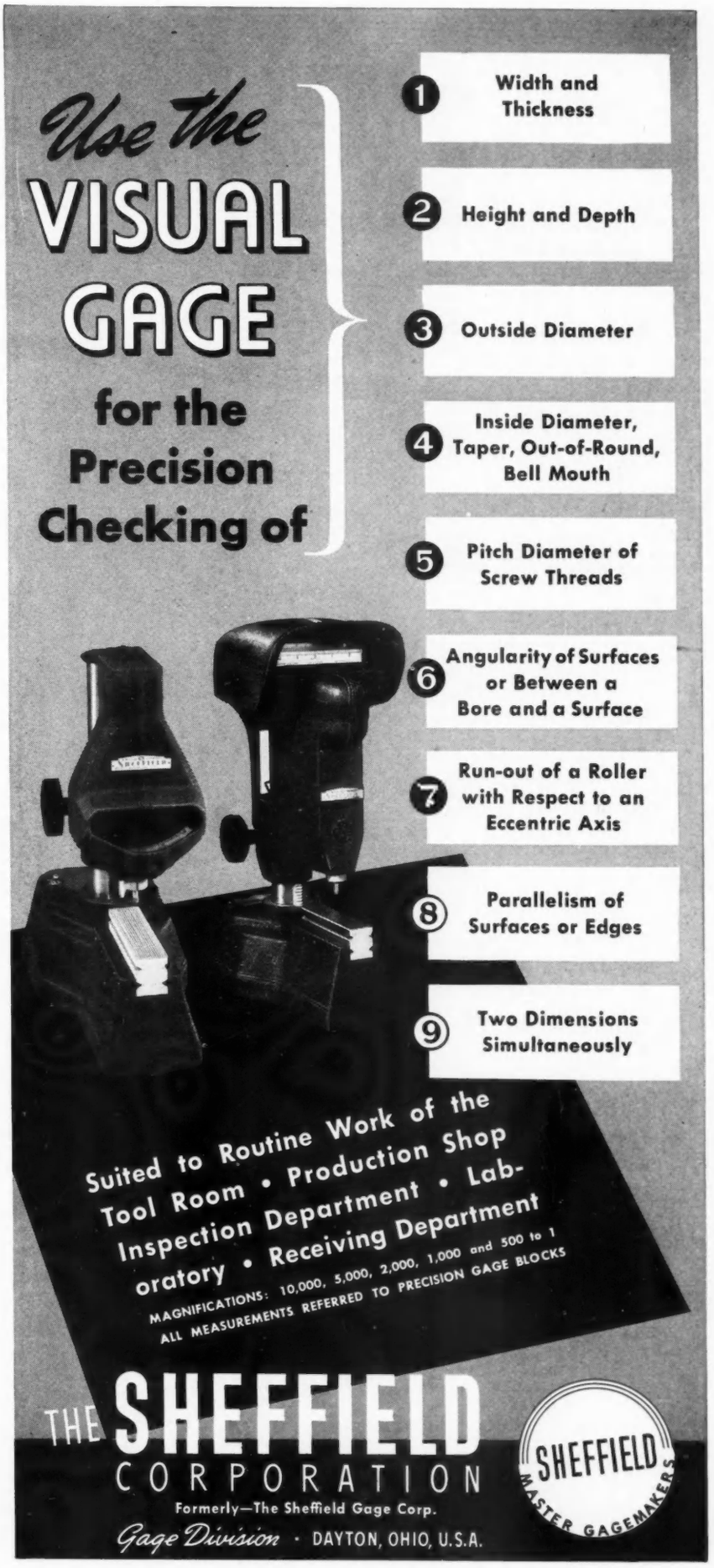
J. William DeBeaubien, 54, chief inspector of war production materials at the Hupp Motor Car Co., died suddenly June 2 at Detroit. He had been associated with the automotive industry since 1914, serving as chief inspector of Oldsmobile and general superintendent of the Pontiac Motor Division of GM.

Capt. Harlan Walker

Capt. Harlan Walker, 43, formerly director of pictorial publicity for the Campbell-Ewald Co., working on the Chevrolet account, died suddenly May 31 at Dayton, Ohio, where he was stationed at Wright Field.

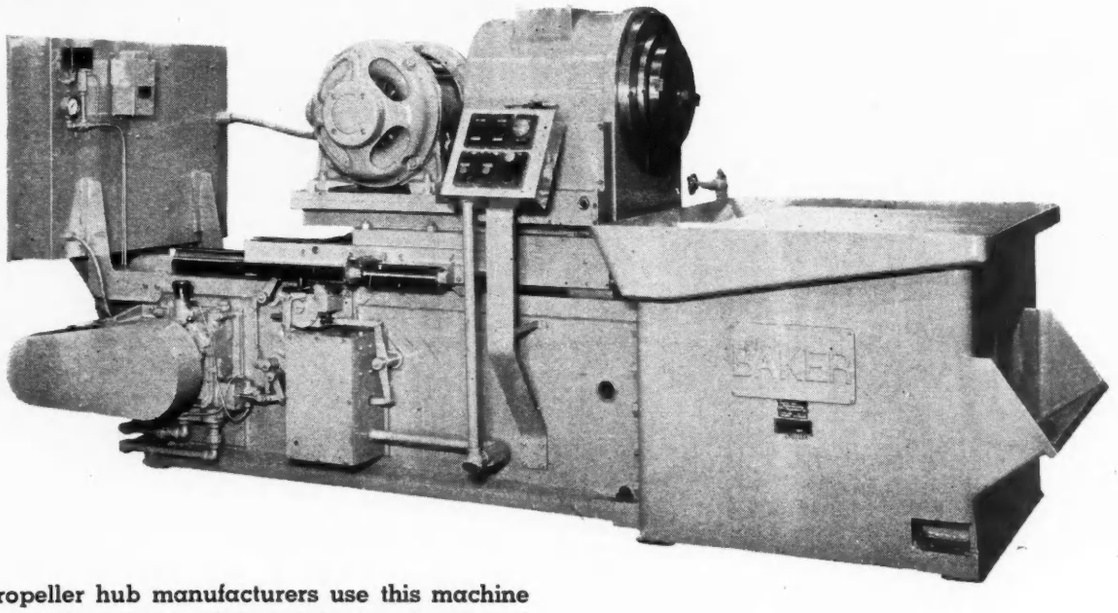


The Mastercraft Turret, an improved model built by the F & M Sales Co., Hollywood, Cal., is a quick-indexing, four-position revolving tool post holding as many as four different cutting tools. Any one of the four tools may be brought instantly into position for performing its operation on the work. As the tool block is rotated from one station to another, each tool "repeats" accurately, thus insuring uniformity of duplicate production.


Use the
VISUAL
GAGE
for the
Precision
Checking of
1 Width and Thickness
2 Height and Depth
3 Outside Diameter
4 Inside Diameter, Taper, Out-of-Round, Bell Mouth
5 Pitch Diameter of Screw Threads
6 Angularity of Surfaces or Between a Bore and a Surface
7 Run-out of a Roller with Respect to an Eccentric Axis
8 Parallelism of Surfaces or Edges
9 Two Dimensions Simultaneously
Suited to Routine Work of the Tool Room • Production Shop Inspection Department • Laboratory • Receiving Department
MAGNIFICATIONS: 10,000, 5,000, 2,000, 1,000 and 500 to 1
ALL MEASUREMENTS REFERRED TO PRECISION GAGE BLOCKS
THE SHEFFIELD CORPORATION
Formerly—The Sheffield Gage Corp.
Gage Division · DAYTON, OHIO, U.S.A.
SHEFFIELD
MASTER GAGEMAKERS

BAKER DRILLS

Baker Horizontal Heavy Duty Drilling and Boring Machine



Propeller hub manufacturers use this machine for drilling from solid and boring the barrel bores which carry the propeller blades. Landing gear parts and breech ring forgings are also drilled and bored on this heavy duty machine.

Features

The saddle of the hydraulic feed floor type unit is mounted on four nitroalloy bars with X-alloy bushings in saddle. This maintains accurate alignment by eliminating the wear that occurs on flat ways.

The unit is automatic in its cycle with convenient control. The single spindle head is of the latest design with the final drive to a very large spindle through cone worm gears. An additional feature that helps to promote smooth cutting action is the use of large diameter preloaded ball bearings.

Two quick-change speeds of the spindle provide the flexibility for different diameters of operations. The spindle driving end is flanged for mounting large diameter cutter heads, with a minimum of overhang.

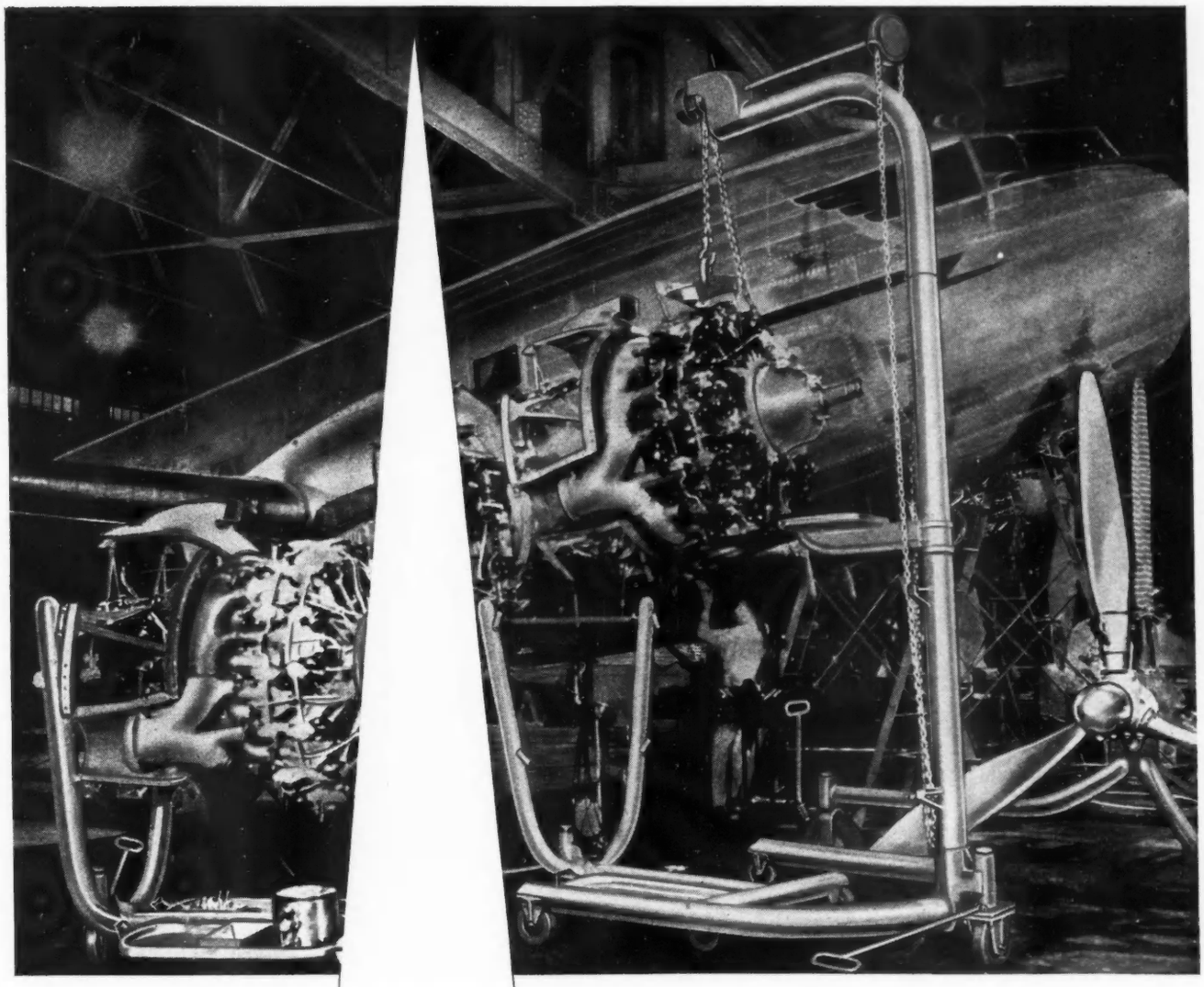
The machine illustrated is a one-way horizontal. The standard floor-type unit and the extra heavy duty single spindle heads can be arranged into a two-way or three-way machine.

OUR MOTTO SINCE 1867

"MACHINES: STURDY and EFFICIENT, AS FINE AS CAN BE BUILT"

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

DRILLING • BORING • TAPPING • AND • KEYSEATING MACHINES



ONE FLIES

. . . but a score work to make his flight successful

What about the equipment for the men on the ground?

The coming of the new giants of the sky . . . the great production lines on which they're built . . . and the need for ever faster, better service for them when on duty . . . have brought their own new assembling, handling, and maintenance problems.

These are the problems of the mechanics who ready the ship for a single pilot. These are the problems that Whiting Aviation Department studies . . . solves. With its long background of experience with handling equipment and metalworking machinery, Whiting has combined an air-minded understanding of the growing requirements of the aviation industry.

One of the standard units in the Whiting line of Matched Handling Equipment . . . or some entirely new device built by Whiting engineers to your own particular requirements . . . may clip hours from your aircraft assembly or maintenance operations.

On such problems, consult Whiting.

WHITING CORPORATION

Main Office and Plant: 15699-A Lathrop Ave., Harvey, Ill.
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AVIATION DEPARTMENT

Scorching Heat or Freezing Cold... **wherever goods of war must go... Protect Them with FIBREEN**

Planes, tanks, guns, trucks, ammunition, food, clothing, medical supplies and vital repair parts that pour from American production lines, *may see service from the arctic circle to the equator.* They may be weeks at sea—stand long outside exposure to freezing cold, to water, to snow and ice, or steaming tropical heat, and destructive sand, dust and dirt.

But when the time comes to go into action, these materials of war must be undamaged—ready.

That's why protective packing is of such major importance now. And that's where FIBREEN is doing an outstanding job in the nation's war program. This rugged paper does its job under any temperature—is unbelievably tough, and is completely proof against moisture, wind and dirt.

It's reenforced with two crossed layers of wire-strong, closely spaced fibres, embedded with two layers of special asphalt between two layers of clean, strong kraft. FIBREEN is pliable and easy to handle—a perfect wrapping or lining material—a superior, low-cost replacement for fabrics and other materials now impossible to get.

FIBREEN is being supplied for the wartime needs of the nation. If you are making an essential war product—if unfailing protection in shipment and storage is a problem—we invite your inquiry. Write for samples. Tell us what you make and how you pack it. Our packing experts are ready to help you, without obligation.

THE SISALKRAFT CO.

Manufacturers of Sisalkraft, Fibreen, Sisal-X, Sisaltape and Copper-Armored Sisalkraft.

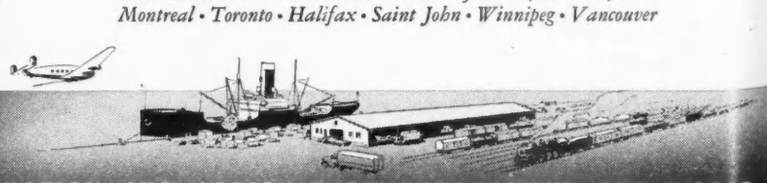
205 W. WACKER DRIVE • CHICAGO, ILL.

NEW YORK SAN FRANCISCO LONDON SYDNEY

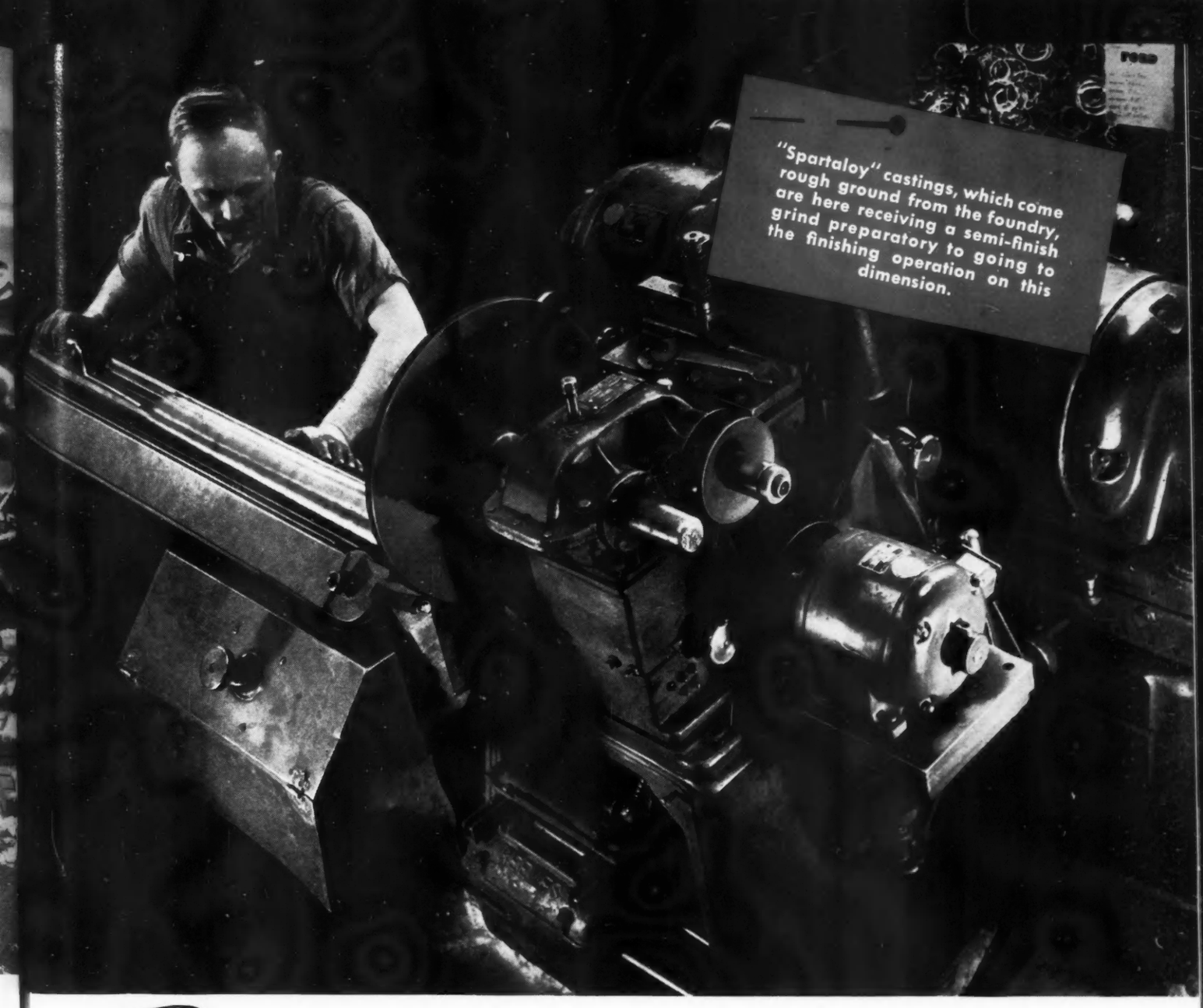
In Canada Write to Alexander Murray & Co., Limited, at Montreal • Toronto • Halifax • Saint John • Winnipeg • Vancouver

FIBREEN

EFFECTIVE *Protection* IN TRANSIT—IN STORAGE—FOR EMERGENCY USES



SERVING INDUSTRY, CONSTRUCTION AND AGRICULTURE THROUGHOUT THE WORLD


"Spartaloy" castings, which come rough ground from the foundry, are here receiving a semi-finish grind preparatory to going to the finishing operation on this dimension.

Grinding—WITH SPEED AND PRECISION

MUSKEGON Piston Rings

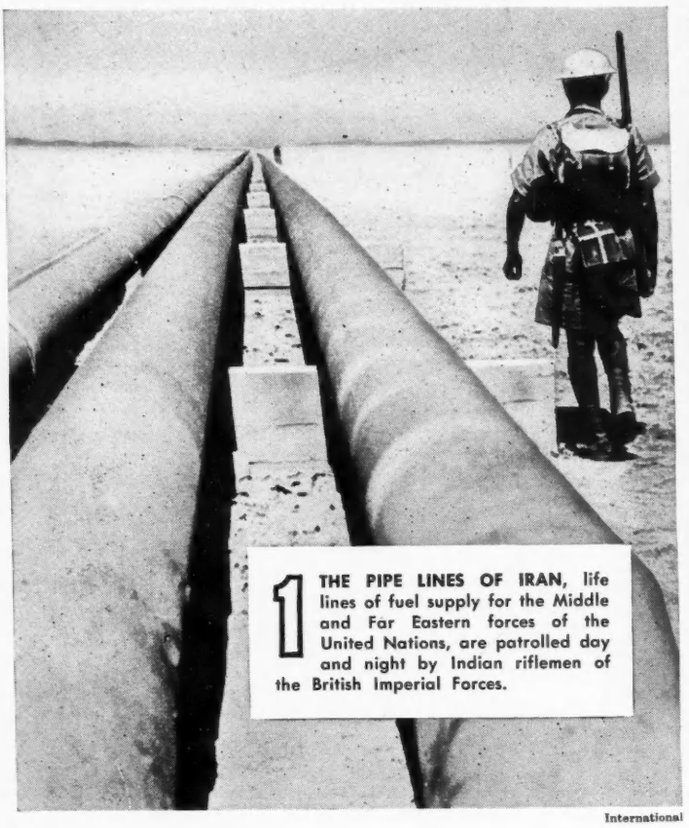
The combination of speed with precision—that phenomenon which characterizes American industry and sets it apart from the industry of all the world—is nowhere better exemplified than in the side-grinding of piston rings at Muskegon. But at no time does Muskegon sacrifice quality for speed. Thus you will find Aircraft and Tank builders relying upon Muskegon rings in war just as the leading volume automotive producers had learned so long ago to do in peace.

Muskegon engineers are ready to apply their experience to your piston ring problems.

MUSKEGON PISTON RING CO.
Muskegon, Michigan
Plants at Muskegon and Sparta

MUSKEGON MPR PISTON RINGS

FAMOUS LIFE LINES



1 **THE PIPE LINES OF IRAN,** life lines of fuel supply for the Middle and Far Eastern forces of the United Nations, are patrolled day and night by Indian riflemen of the British Imperial Forces.

International

2 **"LIGHTNING" STREAKS AT WELL OVER 400 M.P.H.!** And many of the life lines of U. S. warplanes—primer tubes for engines, control tubes and air-bleeder tubes for propellers, carburetor compensator tubing—are by Bundy.

Rudy Arnold

STRENGTH and light weight — these are the qualities which day by day are turning up dozens of new mechanical and structural applications of Bundy Tubing for war production.

Antennae, spacer and structural tubing for various types of radios; conduit tubing for tanks and trailers; stabilizer tubing for ground flares and shade rib supports for parachute flares; parachute rip cord grips; vent tubes for expeditionary gas cans; structural tubing for military lamps of every type—these are but a few of the hundreds of mechanical applications for Bundy Tubing.

And, of course, as war production grows, so grow the uses for Bundy Tubing in every type of automotive and refrigeration application for the armed forces. These two industries long ago accepted Bundy as standard for strength, for ductility and for resistance to vibration fatigue. Wherever automotive and refrigeration products go in the service of the armed forces of our country, there you will find Bundy Tubing.

If your war contract requires tubing anywhere near Bundy's range of sizes — whether the application is mechanical or for carrying fuel, lubricants or refrigerants — you should have the complete Bundy story. Write Bundy Tubing Company, Detroit, Michigan.

BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS

BUNDYWELD double-walled steel tubing, hydrogen-brazed, copper-coated inside and outside. From Capillary sizes up to and including $\frac{1}{16}$" O. D. This double-walled type is also available in steel, tin-coated on the outside, and in Monel.

BUNDY ELECTRICWELD steel tubing. Single-walled — butt welded — annealed. Also furnished tin-coated outside if desired. Available in sizes up to and including $\frac{5}{8}$" O. D.

BUNDY "TRIPLE-PURPOSE" MONEL tubing. Double-walled, rolled from two strips, joints opposite, welded into a solid wall. Available in all Monel, Monel inside —steel outside, and Monel outside —steel inside. Sizes up to and including $\frac{5}{8}$" O. D.

BIG NEWS IN THE 90'S

BIGGER NEWS TODAY!

HYATTS CERTAINLY HELPED TO MAKE IT THAT WAY!

FROM "HORSELESS AGE" MAY 1896

The Hyatt Roller Bearing

Some years ago John W. Hyatt, the well-known inventor in the celluloid line, undertook an exhaustive series of experiments with the object of producing a practical roller bearing. The result of these experiments was the Hyatt Roller Bearing, which from the time it was first placed on the market has been steadily gaining in favor as its merits as a friction saver become known.

The peculiar feature of the Hyatt bearing is that the rollers are both flexible and elastic, which contributes greatly to its durability and decreases the friction of the bearing. When under a load the pressure is automatically distributed over a number of rollers. On this account it is not necessary to harden the rollers and the surfaces with which they come in contact, as is the case when solid rollers are used.

Wherever thoroughly tested these rollers have fully borne out the claims of the manufacturers. They are being successfully employed in shafting of all kinds, street cars, bicycles, wagons and high speed machinery of all kinds.

Quite a number of motor inventors have adopted them for axle bearings, finding friction greatly reduced.

The Hyatt Roller Bearing Company have a factory in Newark, N. J., at 450 Market Street, and a New York office at 133 Liberty Street, where they will be pleased to see those in search of further information.

BUT HOW THESE BEARINGS HAVE IMPROVED IN DESIGN AND CAPACITY OVER 50 YEARS! WHAT A PRECISION BEARING HYATT IS TODAY!

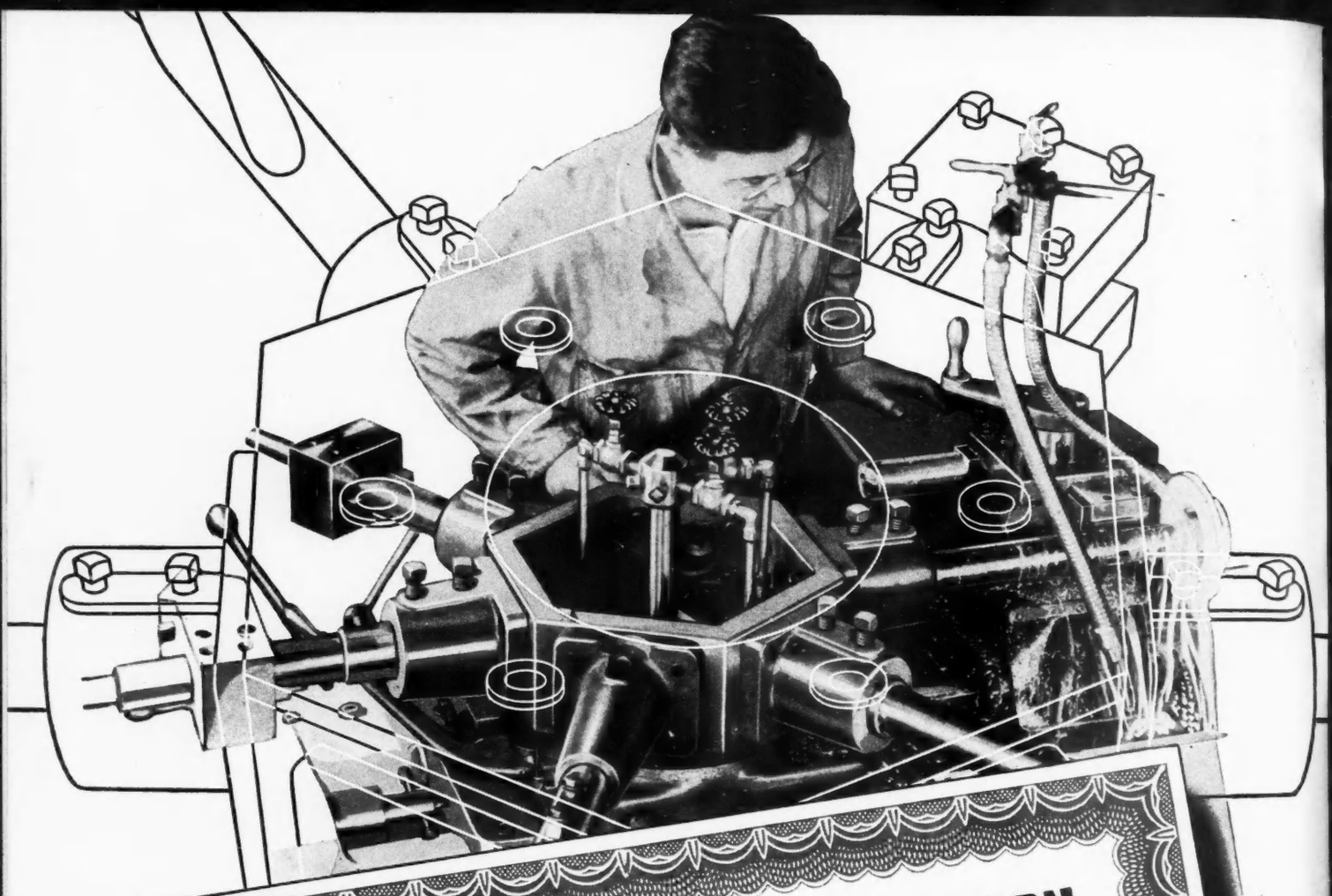
...AND NOW, YOU'LL FIND HYATTS IN CADILLACS, BUICKS, CHEVROLETS, ETC., AS WELL AS IN FARM MACHINERY, INDUSTRIAL APPLICATIONS, AND IN TODAY'S MIGHTY FIGHTING EQUIPMENT.

THIS OFFER STILL GOES! DROP IN... OR DROP A LINE ANY TIME TO... HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION, HARRISON, NEW JERSEY, WHERE FACTORY AND OFFICES ARE NOW LOCATED.

THE 50TH YEAR OF

HYATT ROLLER BEARINGS

1892-1942



SOUND INVESTMENT IN PRODUCTION

—*Present and Future*

When you invest in plant equipment, look for production values—the demonstrated ability of one machine against another to produce swiftly, faithfully, and economically. Not just for the present, but over a period of years. You eliminate guesswork when you buy Gisholt Turret Lathes. You buy proved performance—known values in speed, accuracy, long life. The new Gisholts which are doing so much to speed defense production today, will also serve their owners as a hedge against whatever the post-war world may bring.

GISHOLT MACHINE COMPANY
1205 WASHINGTON AVENUE, MADISON, WISCONSIN

Look ahead · · · Keep ahead · · · with Gisholt improvements in metal turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Need Parts Like These?

These illustrations are purposely distorted and drawn out of scale.

SPEED ASSEMBLY WITH SHAKEPROOF FASTENINGS

Cowl Fasteners for Aircraft

Lock Washers

Thread-Cutting Screws

SEMS Fastener Units

Locking Screws

Locking and Plain Terminals

New 20-page booklet illustrates and describes the facilities of our two plants in detail. Available to company executives and government officials on request.

SHAKEPROOF

is geared for volume production of high precision stampings and cold headed products!

Shakeproof offers the facilities of two modern plants thoroughly equipped for Die Making—Stamping—Drawing—Cold Heading—Thread Rolling—Heat Treating and Plating. And, a well-manned technical staff of competent metallurgists and experienced production, research and field engineers.

If you are in need of a reliable source for parts similar to those illustrated above, our organization has the experience and the equipment to quickly deliver a product of highest commercial standards.

Quotations can be furnished from blueprints or one of our field engineers will gladly call for personal discussion.

SHAKEPROOF INC.

Fastening Headquarters

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
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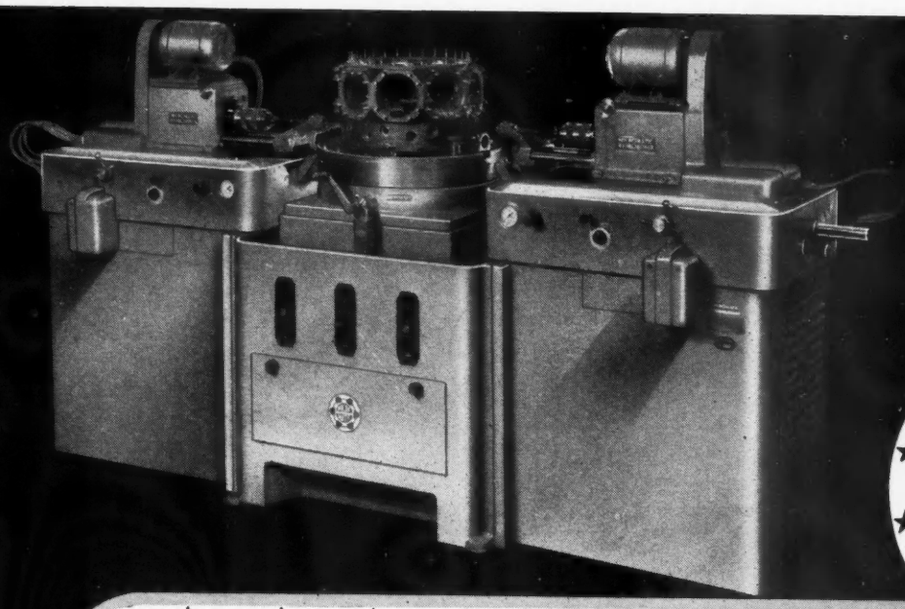
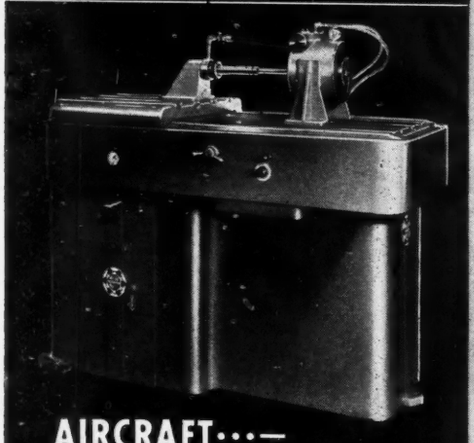
Plants at Chicago and Elgin, Illinois
In Canada: Canada Illinois Tools, Ltd., Toronto, Ont.

SEMS FASTENER UNITS • LOCK WASHERS • LOCKING AND PLAIN TERMINALS • THREAD-CUTTING SCREWS • LOCKING SCREWS
SPRING WASHERS • RADIO AND INSTRUMENT GEARS • COWL FASTENERS • SPECIAL STAMPINGS

Honing valve guides after assembly in crankcase (Radial Aircraft Engine) on Double End Hydrohoner with Micr-O-Size control—production 3 to 6 complete assemblies per hour—removes average of .0005" to .001" stock per bore—generates uniform size within .0003" to .0005", accuracy within .0001" to .0003" and surface finish within 3 to 5 micro-inches, r.m.s.

AIRCRAFT···—





AIRCRAFT···—

Feathering Oil Pump Gear Teeth (Aircraft Engine) external honing.

FOR VICTORY PRODUCTION

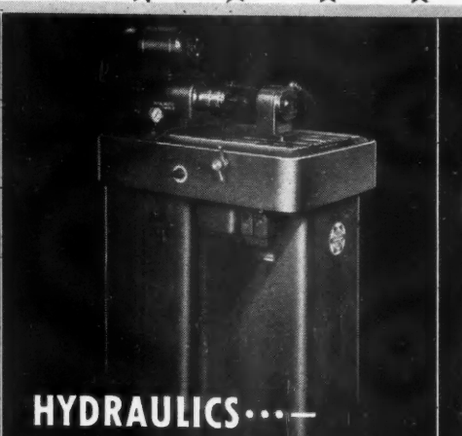
SAVE TIME ★ SAVE METAL ★ SAVE COST ★ IMPROVE QUALITY

AIRCRAFT···—

Honing Piston Pin Bores (Aircraft Engine).

AIRCRAFT···—

Honing Valve Guides (Aircraft Engine) before assembly.



HYDRAULICS···—

Honing O.D. of pistons for a variable delivery pump.

Honing cast iron valve guides on full automatic Hydrohoner with Micr-O-Size control—Production 250 pieces per hour. Average Stock removed, .0015″ to .0025″—Size within .0005″ tolerance; accuracy within .0001″ to .0002″; surface finish within 3 to 5 microinches, r.m.s.

Honing Piston Pin holes (in Piston) on Double Spindle Hydrohoner with Micr-O-Size control.

AUTOMOTIVE···—

Microhoning has been adopted in most armament production shops to speed up the final processing operation on vital bearing surfaces.

Microhoning generates final surfaces with the minimum amount of stock removal.

Microhoning saves sufficient processing time and cost in some installations, it is reported—even *to pay for the machine in 30 to 40 operating days.*

Microhoning controls cutting pressure, speed and motion to produce maximum obtainable quality of generated surfaces.

Write for Bulletins AR60 and AR64 for further details.

MICROMATIC HONE CORPORATION

1345 E. MILWAUKEE AVE. DETROIT, MICHIGAN

ORDNANCE···—

Double Spindle Hydrohoner with Micr-O-Size control for honing gun charger tube bores.

HYDRAULICS···—

Honing blind end bores in a variable delivery pump body.

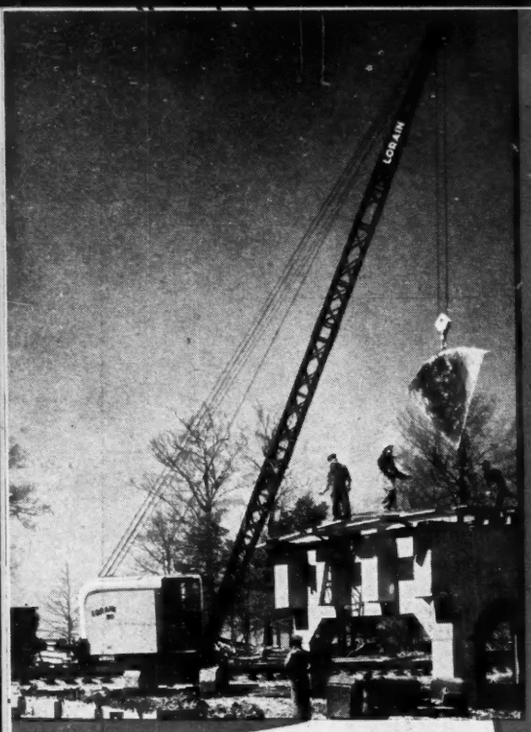
HYDRAULICS···—

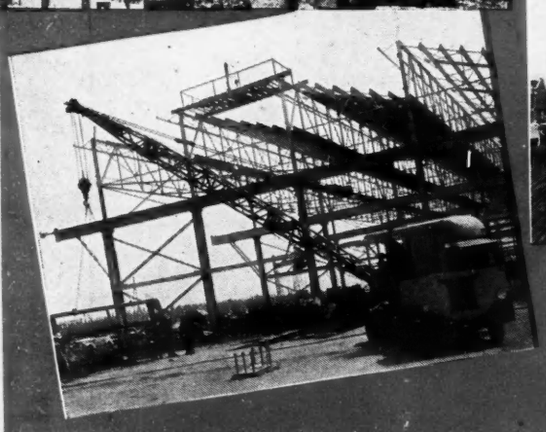
Honing bores in hydraulic valve body on Micromatic Hydrohoner.

ORDNANCE···—

Honing pinion shaft bores in hardened planetary gear for military vehicle.

More Power for

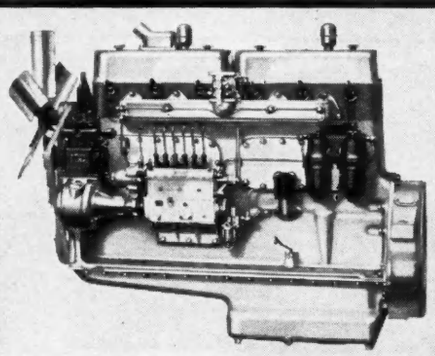




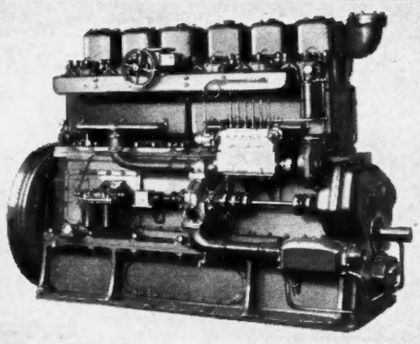
WAUKESHA

POWER... THE FIRST LINE OF OFFENSE. Before the Army or Navy armed forces are trained, in cantonments, naval bases, airports... before bombers are built, or powder produced... before ships slide off the ways—power takes the offensive!

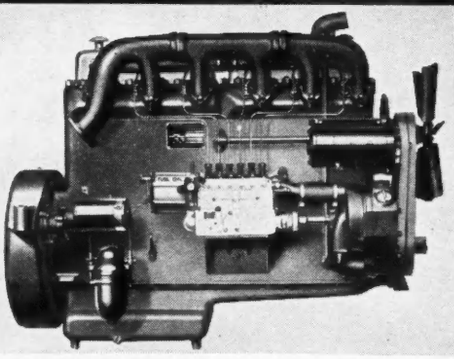
Power... for trucks and tractors... for air compressors and hammers... for crushers and cranes... shovels, mixers, pavers, graders... lighting generators. Power... for oil well drilling



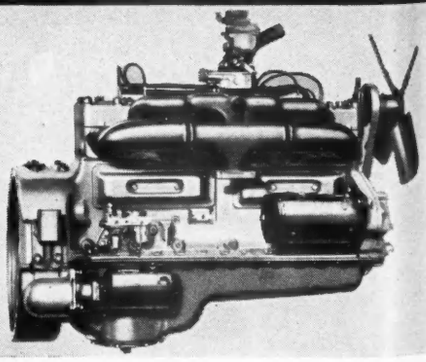
Model WAKH Waukesha Oil Engine. Automotive, Industrial, Stationary, and Marine.



Model LRH Waukesha Oil Engine. Industrial, Stationary, and Oil Field.



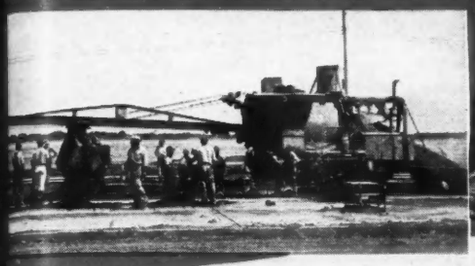
Model 145 HK Waukesha Multi-Fuel, Oil Engine. Automotive, Industrial, Marine, and Stationary.



Model MZR Waukesha Gasoline Engine. Automotive, and Industrial.

WAUKESHA MOTOR COMPANY

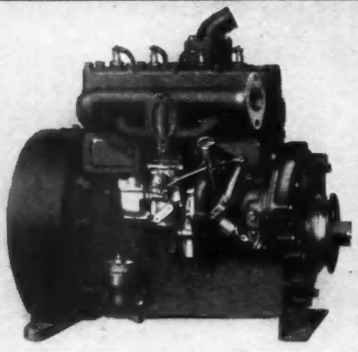
VICTORY



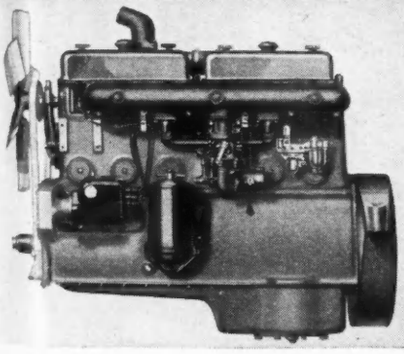
ENGINES

and pumping, for the fuel to feed itself. Power . . . for the implements of field and farm, for the food that feeds the man power that works and fights.

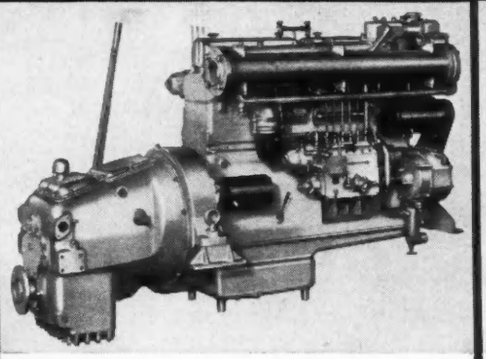
Power . . . built into Waukesha Engines as only Waukesha knows how to build it in. Waukesha Engines for Automotive, Marine, Stationary and Industrial Power . . . oil or gasoline . . . from 5 hp. to over 300 hp. Get Bulletins 1079 and 1200.



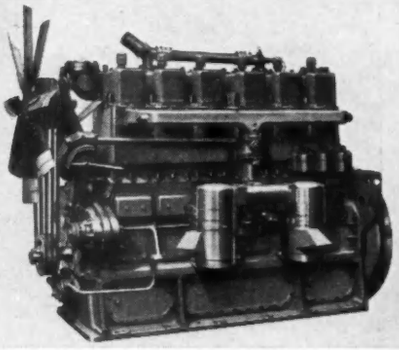
Model ICK Waukesha Gasoline Engine. Automotive, Industrial, Refrigeration, and Electric Generation.



Model 140 GK Waukesha Multi-Fuel, Gasoline Engine. Automotive, and Industrial.



Model 145 HKM Waukesha Marine Oil Engine, with reduction and reverse gear.



Model LRO Waukesha Gas Engine. Industrial, Stationary, and Oil Field.

WAUKESHA, WIS. New York Tulsa Los Angeles

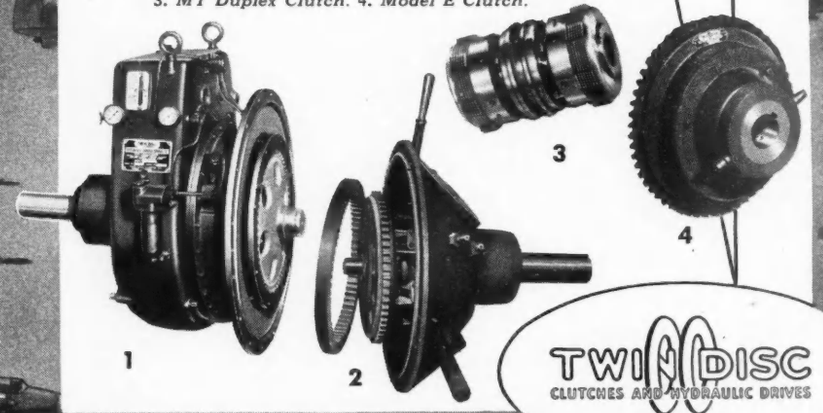
On the Alert

TO SERVE YOU. Under present conditions, one of the most important services a clutch manufacturer can offer industry is a competent and adequate parts and service organization to assure uninterrupted production, prevent costly delays in waiting for factory shipments of needed parts.

That's why the Twin Disc Clutch Company maintains seven strategically-located, factory-controlled branches and 30 parts and service stations, each with ample stocks of parts. Skilled service men are on call 24 hours a day, constantly "on the alert" to serve you . . . to prevent time-consuming delays due to accident or any other cause.

When in need of parts or service, call your nearest Twin Disc representative.

1. Hydraulic Torque Converter. 2. Power Take-off. 3. MT Duplex Clutch. 4. Model E Clutch.



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

Alabama: Montgomery, Parts Service Corp. **California:** Los Angeles, Charles W. Carter Co.; San Francisco, Charles W. Carter Co. **Colorado:** Denver, Liberty Trucks & Parts Co. **Florida:** Jacksonville, Motor Parts & Supply Co. **Illinois:** Chicago, Wisconsin Industrial Parts. **Kansas:** Great Bend, Scheufler Supply Co. **Kentucky:** Lexington, Wombwell Auto Parts Co. **Louisiana:** New Orleans, Mechanical Equipment Co. **Maine:** Portland, Southworth Machine Co. **Massachusetts:** Boston, Rapp Huckins Co., Inc. **Michigan:** Detroit, W. C. DuComb Co., Inc. **Minnesota:** St. Paul, Trucks Parts, Inc. **Missouri:** St. Louis, Twin Disc Clutch Co. **New York:** Buffalo, Edward W. Rode; New York City, Twin Disc Clutch Parts & Service of New York, Inc. **Ohio:** Cincinnati, C. McCash; Cleveland, Twin Disc Clutch Co.; Industrial Eng. Parts. **Oklahoma:** Tulsa, Twin Disc Clutch Co. **Pennsylvania:** Pittsburgh, Contractors Equip. Ser. Co.; Philadelphia, Twin Disc Clutch Parts & Service of Philadelphia. **Tennessee:** Knoxville, Automotive Equip. & Supply Co.; Memphis, Choctaw Culvert & Mchy. Co. **Texas:** Dallas, Twin Disc Clutch Co.; Fort Worth, Jno. Muller Co.; Houston, Portable Rig Co., Inc.; Jno. Muller Co. **Utah:** Salt Lake City, Lund Machinery Co. **Virginia:** Richmond, Standard Parts Corp. **Washington:** Seattle, Twin Disc Clutch Co. **Canada:** Montreal and Toronto, Consolidated Engines and Machinery.

TWIN DISC CLUTCH COMPANY, 1344 RACINE STREET, RACINE, WISCONSIN

3 REASONS for FASTER QUENCHING SPEED PLUS STABILITY

1. HOUGHTO-QUENCH "G" is an oil made solely for quenching; its make-up includes a percentage of wetting-out agent to speed spreading over metal surfaces.
2. HOUGHTO-QUENCH "G" embodies a further ingredient high in heat absorption, enabling transfer of heat more rapidly from the metal.
3. HOUGHTO-QUENCH "G" contains a patented stabilizing agent which minimizes oxidation or fractional distillation of the oil in service.

You want fast quenching speed—and you get it with Houghto-Quench "G." But that's not all: you also get a lasting power, a stability that keeps Houghto-Quench "G" the same, month after month. You get freedom from sludging; no clogging of cooling systems. You get the proper fire, flash and viscosity. And finally, you get the services of men trained in heat treating who can help you greatly in the many new problems you face today.

For those reasons, insist on HOUGHTO-QUENCH "G" for quenching munitions and war materials.

Products for War Manufacturing
Carburizers
Blackening Salts
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Specialized Lubricants
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ARMY NAVY Star of our

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Form 16 L

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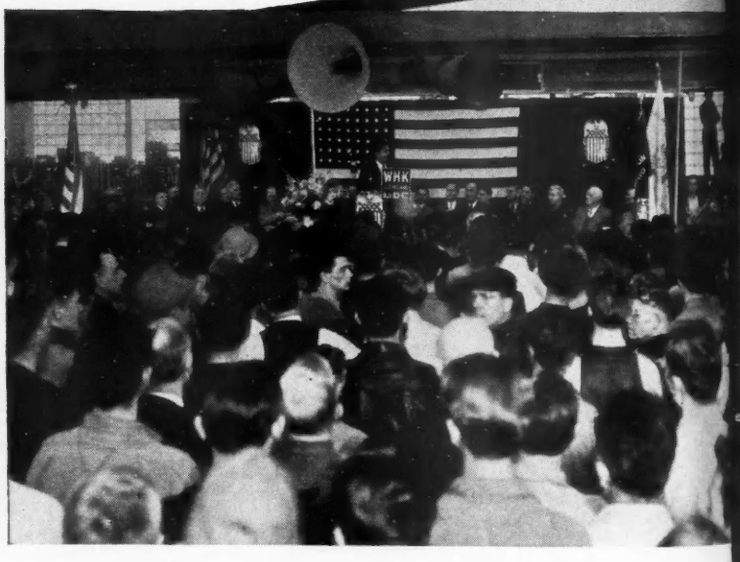
PBR FTHAYES OHIO MAY 20 748 PM
THE MANAGEMENT AND EMPLOYEES OF THE NATIONAL ACME CO., CLEVELAND OHIO.
THE ARMY AND NAVY ARE PROUD TO INFOHM YOU THAT THE ARMY AND NAVY STAR IS TO
BE AWARDED TO YOU IN RECOGNITION OF YOUR FINE WAR PRODUCTION RECORD. YOUR
TOOLS HAVE AIDED IN THE PRODUCTION OF PLANES, TANKS, GUNS AND SHIPS WITH WHICH
OUR FIGHTING FORCES ARE CARRYING ON. THE ARMY AND NAVY ARE LOOKING TO YOU AS
SOLDIERS OF PRODUCTION FOR THE ESSENTIAL TOOLS AND THE ESSENTIAL WEAPONS. WE
KNOW YOU WILL CONTINUE TO RESPOND AND NOT ONLY KEEP UP BUT IMPROVE YOUR PRESENT
FINE RECORD. OUR CONGRATULATIONS.

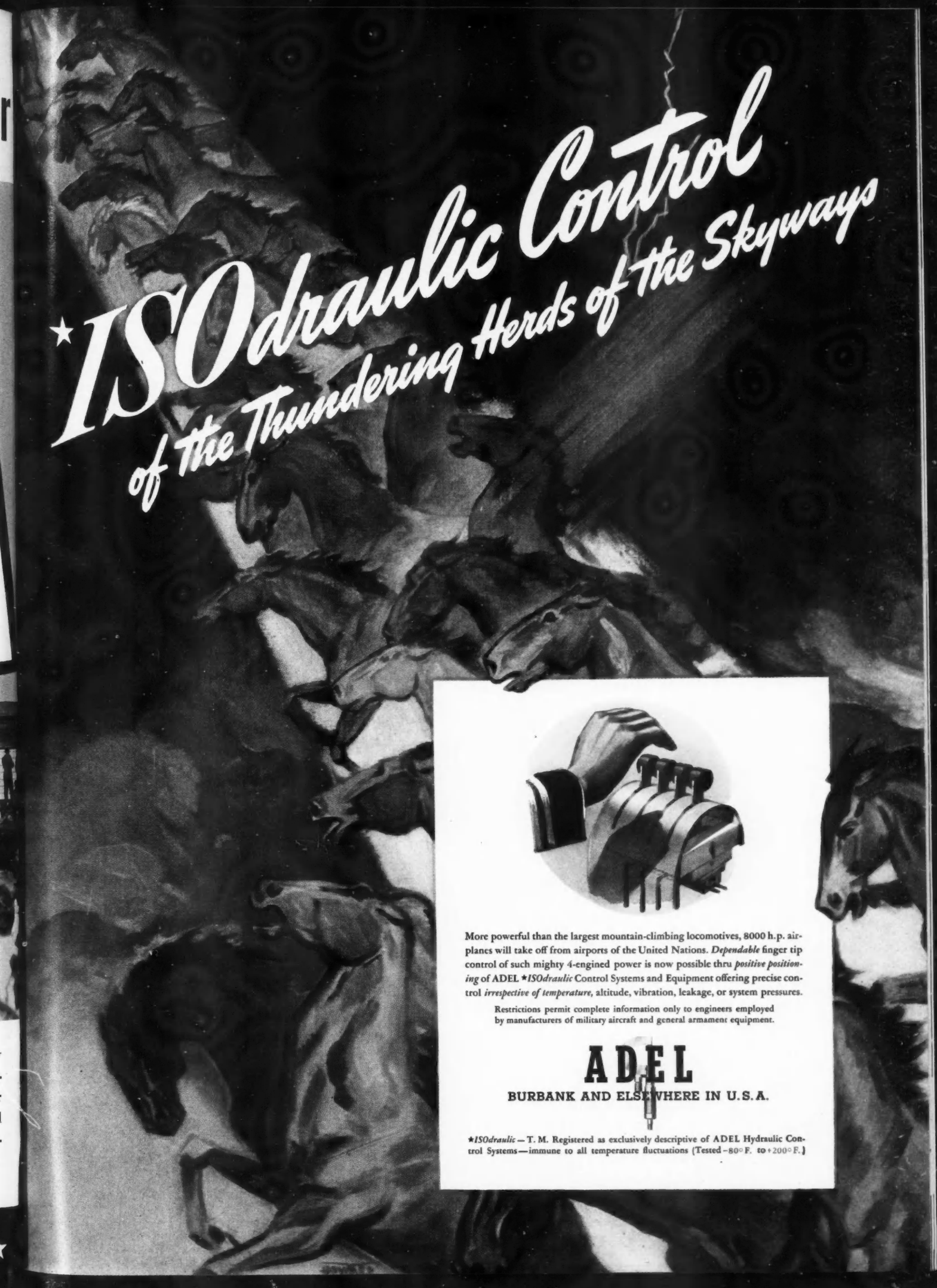
PATTERSON, UNDER SECRETARY OF WAR,
FORRESTAL, UNDER SECRETARY OF THE NAVY,
WASHINGTON, DC.



AT PRESENTATION ceremonies in National Acme plant, F. H. Chapin, President (center) and M. Bizovsky, local MESA president (left), accepted the award on behalf of their fellow workers. To James Forrestal, Under-Secretary U. S. Navy, and Col. S. E. Reimel, Army-Navy Munitions Board, they pledged continued full support of Nation's war effort.

WORKERS CHEERED compliments on their achievement by Cleveland's Mayor F. J. Lausche (speaking) and by high-ranking Army and Navy officers. They went back to their jobs with renewed determination to beat their phenomenal machine and tool production record, which has already increased over 600%.

★ ★ ★ ★ ★ ★ ★



More powerful than the largest mountain-climbing locomotives, 8000 h.p. airplanes will take off from airports of the United Nations. *Dependable* finger tip control of such mighty 4-engined power is now possible thru *positive positioning* of ADEL ★*ISOdraulic* Control Systems and Equipment offering precise control *irrespective of temperature,* altitude, vibration, leakage, or system pressures.

Restrictions permit complete information only to engineers employed by manufacturers of military aircraft and general armament equipment.

ADEL

BURBANK AND ELSEWHERE IN U.S.A.

★*ISOdraulic* — T. M. Registered as exclusively descriptive of ADEL Hydraulic Control Systems — immune to all temperature fluctuations (Tested −80° F. to +200° F.)

Here's how you can
STOP WASTING COPPER

New method of deplating, developed by Du Pont, permits recovery of practically 100% usable metal

IF you are using copper plate as a stop-off in localized hardening and for other purposes, this new du Pont process is just what you need to conserve copper. Consider that:

1. Practically 100% of the deplated metal is recovered in a form satisfactory for direct reuse as anode material.
2. The recovery or deplating is carried out in cyanide solutions.
3. The recovery equipment comprises heated, unlined steel tanks, conventional work rods, and preferably an agitator.
4. Deplation can be carried out rapidly; up to 0.001″ of copper can be removed in 9 to 10 minutes using current densities up to 60 A/SF.
5. Deplating takes place without attack of the base metal—in decided contrast to usual stripping methods.

Call on du Pont Technical Service for working information and assistance.

DU PONT
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CHEMICALS
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E. I. DuPONT DeNEMOURS & COMPANY (INC.)
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Call the roll of U.S. War Birds

. . . and serving in practically all, you'll find

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For REMOTE CONTROL
of Radio Transmitters
Radio Receivers
Beacon Receivers
Compass Loops
Antenna Loops
Antenna Reels
Heating Registers
Trim Tabs
Turn Bank Indicators
Prestone Shutters
Gyro Pilots
Aircraft Guns

For DRIVING
Engine Tachometers
Tachometer Generators
Fuel Pumps
Controllable Pitch Propeller Governors
Ammunition Rounds Counters
Windshield Wipers
Cowl Flap Mechanisms
Starters

At the left is a partial list of the important jobs that S. S. White Flexible Shafts are doing in war planes.

They are serving also in various power drive and remote control applications in aviation ground equipment, and in tanks, ordnance, naval, signal corps and other war material.

Eager to do all we can to further the nation's war effort, we are going the limit to meet all demands. If you need flexible shafts let us know your requirements. We'll do everything possible to satisfy them. Call on us also for engineering cooperation on any power drive or remote control problem.

FLEXIBLE SHAFT DATA FOR ENGINEERS

BULLETIN 839
Flexible Shaft Combinations for Aircraft.

BULLETIN 1238
Flexible Shafts for Power Drives.

BULLETIN 38
Flexible Shafts for Remote Control.

COPIES MAILED TO YOU ON REQUEST.

S. S. WHITE

The S. S. White Dental Mfg. Co.

INDUSTRIAL DIVISION

Dep't A, 10 East 40th St., New York, N. Y.

PIONEER AND LEADING MAKER OF FLEXIBLE SHAFTS FOR POWER DRIVES, REMOTE CONTROL AND COUPLING

BIRDSBORO
BIRDSBORO

to Tokyo! Whether they are Yanks flying the shortest route to Tokyo, or the "Flying Tigers" hell-diving over the Burma Road . . . the chances are that many of the vital parts of the planes used to get them there and back were made with the help of Birdsboro Hydraulic Presses such as these.

On production lines in many of the nation's leading aircraft plants, Birdsboro Hydraulic Presses are working 24-hour shifts — to produce more planes and better planes, in memory of December 7th.

BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY

Birdsboro, Pennsylvania

BIRDSBORO

HYDRAULIC PRESSES

Felters Felt, in various forms, is used in the production of military vehicles and aircraft in many important ways . . . both in its own right and as a substitute for rubber and cork.

As examples, Kapok Unisorb Flame-proofed Felt insulates against cold, deadens sound and saves important weight over other types of insulation. Felters Felt Washers in military vehicles keep dust, grit and mud out of bearings and joints—yet retain the all-important lubricating grease and oil.

Felters Felt is made to S. A. E. and Army and Navy specifications. Send for further literature concerning Felters Felt, or submit specific problems to our engineering department.

THE *Felters Company* INC.

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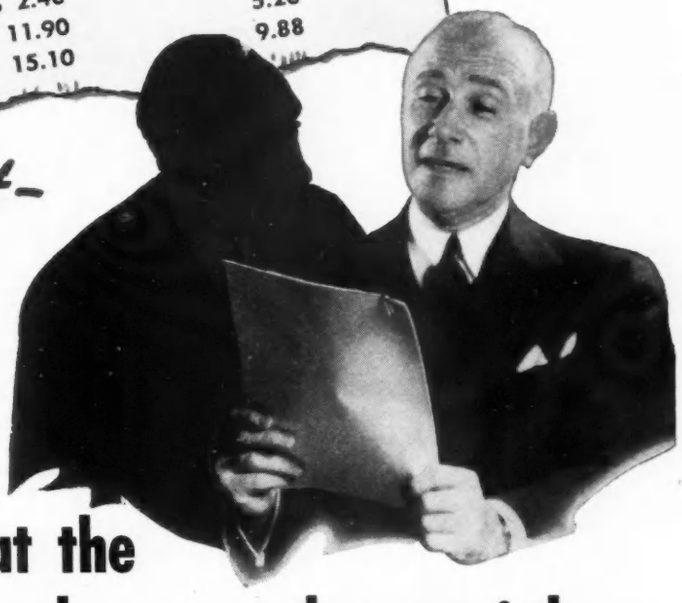
Offices: New York, Philadelphia, Chicago, Detroit • Sales Representatives: Dallas, Los Angeles, Nashville, St. Louis, St. Paul • Mills: Johnson City, New York, Millbury, Massachusetts, Jackson, Michigan

then I said to myself—



...and look at the saving in man-hours and materials

Sure, design for cost-saving is always important... but right now design for saving man-hours and materials is vital.

ALTER EGO: Isn't that just what the designers of this trailer chassis did? By changing over to welded design, they've saved 20% in man-hours and 25% in weight of iron and steel, in addition to costs such as shown.

Yes, but how about the man-hours required to change over designs and to convert production to welding?

ALTER EGO: It's simple and quick. Designs can be changed gradually, one part at a time. Production fixtures for the welded parts can be built easily and quickly.

Then, doesn't that account for the industry-wide swing to welding? Everybody sees in this process a means of getting into production quicker and producing faster... to win the war.

ALTER EGO: Not only to win this war but to survive in the Battle for Business after this war. Why shouldn't we start by studying the Lincoln Handbook of Design and Practice and applying some of its suggestions? Everyone says it's the authentic reference guide on arc welding.

"Procedure Handbook of Arc Welding Design and Practice." 1120 pages. 1557 illustrations. Price $1.50 postpaid in U.S.; $2.00 elsewhere.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

RECTO-PLATERS

for Anodizing

SULPHURIC OR CHROMIC ACID PROCESSES

If your war materiel contract calls for anodizing by either the chromic or sulphuric acid method, be sure to investigate the advantages of the Udylite-Mallory Rectoplater.

RECTOPLATERS ARE QUICKLY AVAILABLE. We maintain stocks of standard Rectoplaters and can make prompt shipment.

A WIDE RANGE OF AMPERE-VOLT COMBINATIONS CAN BE SECURED. By grouping single Rectoplater units in series, practically any anodizing requirement can be filled.

RECTOPLATERS HAVE HIGH CONVERTIBILITY VALUE. When the present need subsides, the Rectoplater anodizing set-up can be broken into individual units for such purposes as barrel and still tank plating, electrocleaning, etc.

We are equipped to design and supply complete anodizing installations. Udylite's experienced engineers will be glad to help you with your metal finishing problems. Call on them—you pay no more for the Udylite dependability.

THE UDYLITE CORPORATION

1651 E. Grand Blvd., Detroit, Mich.

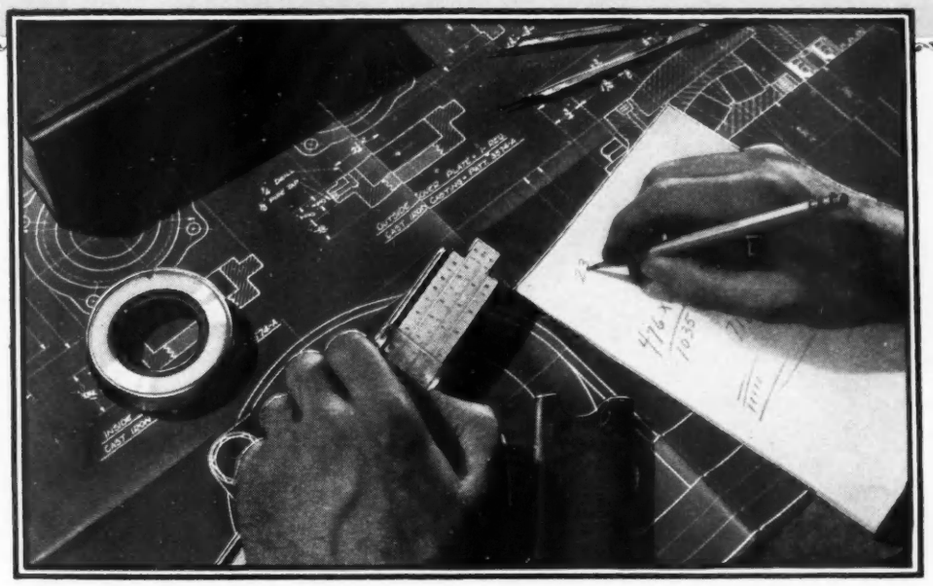
Chicago
1943 Walnut Street

Long Island City, N. Y.
11-16, 44th Drive

Cleveland
4408 Carnegie Ave.

SOME OF THE MANY FACTORS

Governing Proper Choice of Oil Seals



There are certain factors which must be considered in making an intelligent choice of oil seals for any given application. They are:

1. *Size* and finish of Shaft on which the seal will operate.

2. *Space Limitations,* if any, in the housing which carries the seal.

3. *Shaft Speed:* Oak Leather packing members are suitable for speeds up to 750 FPM., Sirvis Leather for speeds from 750-2000 FPM.

FPM = Shaft Diameter x RPM x .26

4. *Operating Temperature:* Oak Leather packing members suitable for temperatures up to 140° F., Sirvis Leather from 140-200° F., Sirvene Synthetic from 200-300° F., High Temperature Sirvene Synthetic up to 400° F.

5. *Fluids:* Leather packing members for contact with oil or grease, Sirvene Synthetic for acids, alkalis, and solvents incompatible with leather.

6. *Operating Pressure:* Pressure of lubricant on the seal or the difference in pressures on the two sides of the seal.

7. *Shaft Motion:* Rotary or reciprocating.

8. *Foreign Matter:* Concentration of air or fluid born abrasive dust or moisture.

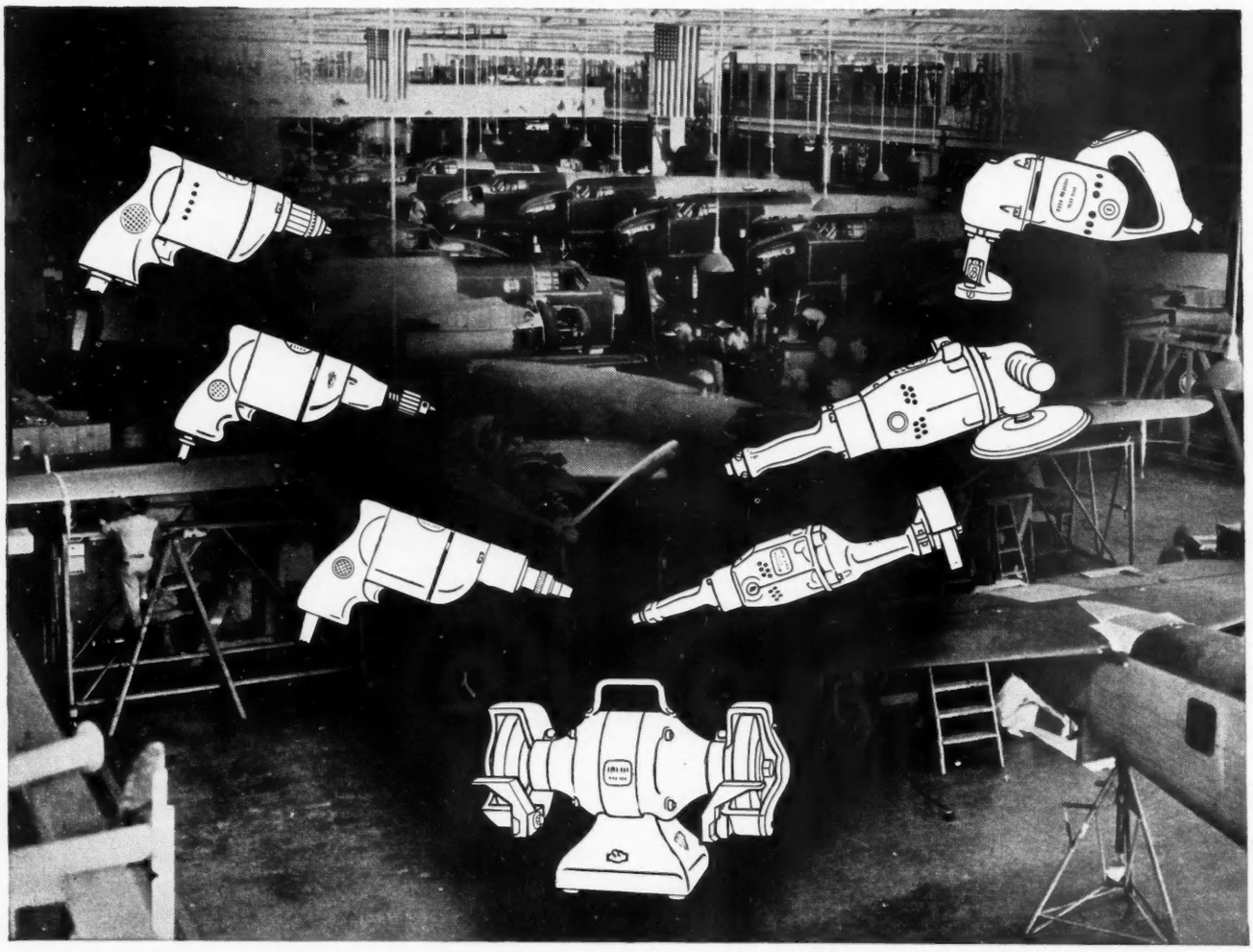
Chicago Rawhide engineers have had a lifetime of experience in dealing with oil sealing problems of all kinds. Consult them.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

64 Years Manufacturing Quality Mechanical Leather Goods
Exclusively and now Sirvene Synthetic Products

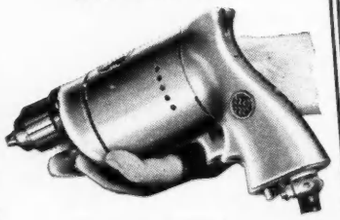
PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON • PITTSBURGH • CINCINNATI



These Tools Are Right

For Top Speed Aircraft Production

Black & Decker HOLGUN



This famous drill, a light, compact "handful of power" is now available in several models to speed up aircraft production. Standard or heavy duty . . . end or side handle . . . choice of 7 no-load speeds from high torque at 500 R.P.M. to a high speed of 5000 R.P.M. Designed for work in tight spots. Powered for continuous drilling. Won't heat up under most extreme service.

Black & Decker Portable Electric Tools are the precise answer to aircraft production lines that must be set up so that speed tools can be *carried to the operation.* And because 32 years of tool engineering have produced a complete line of recognized quality and performance, Black & Decker is ready with tools perfect in power, balance, "feel" and toughness. They are powered each to its job, for continuous work on overtime schedules!

Drills, sheet metal shears, sanders, portable grinders, screw drivers, bench grinders—there are models of portable power tools in the Black & Decker line, for every type of work. They are as light, compact and trim as electric tools can be made. So—whatever your electric tool problem, "Electric Tool Headquarters" has the answer.

Call your Black & Decker Distributor today—or wire for a Black & Decker field engineer to call on you. The Black & Decker Mfg. Co., 781 Pennsylvania Avenue, Towson, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

IMAGINEERING: GETTING OUT OF THE GROOVE

THESE FOUR YOUNG WOMEN, so earnestly mastering the art of torch-welding aluminum, suggest that someone, somewhere, has checked out of the groove and started some practical Imagineering.

THEY PROVE what we've been saying for years: Alcoa Aluminum is easy to fabricate. The man who started the school where these girls are learning, and graduating to war jobs, simply had imagination enough to believe that

easy really means *easy*. Then he did something about it!

IMAGINEERING is letting your imagination soar and then engineering it down to earth. It is ingenuity in modern dress.

IT IS THE THING that has enabled the aluminum industry to keep on top of a plane schedule, increased tremendously in numbers, but also calling for almost twice as much aluminum per plane as the average plane needed two years ago.

IT IS WHAT EVERY ONE OF YOU are doing on your war job. Simplification, standardization, training. New methods, new materials, new records.

THIS WAR is showing Americans what they really can do if they try.

LET'S MAKE a vow to carry this same spirit over into postwar America. We'll all have the skills, the habit of work, the thrill of doing. There will be lots of aluminum to make into better products than peacetime America ever knew. It will be a great day for Imagineers.

Aluminum Company of America, 2110 Gulf Building, Pittsburgh, Pennsylvania.

★ SO MUCH SO SOON ★

ALCOA ALUMINUM

HOW TO GRIND A RIFLE DRILL BY HAND

NEW, FREE GUIDE Will Help You Grind .30 & .50 Calibre Drills on Your Tool Grinder

This booklet has been prepared for practical shop men and for those confronted, for the first time, with drilling rifle barrels. It covers the four basic operations in grinding rifle drills. It is written in simple language, and contains 9 illustrations, together with diagrams, giving proper angles for grinding. Unskilled help with a little practice and proper study of this booklet, should be able to grind rifle drills for efficient drilling of .30 and .50 calibre rifle barrels. Although we do not manufacture rifle drills nor grinders we have supplied many manufacturers with rifle drilling machines. This booklet was originally planned to assist our machine demonstrators in servicing these machines and is offered to you in the interest of better production of rifle barrels on your present drilling equipment.

FREE: *Rifle Drill Grinding Guide*

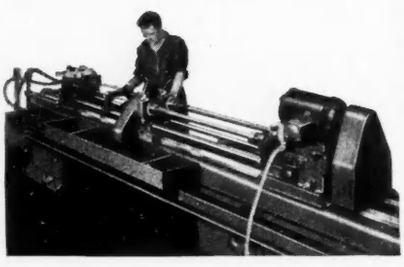
Write for this practical guide today. Use it to teach a simple grinding method to unskilled help. Keep it handy as a reference. It will help maintain production on rifle barrel drilling. Ask for as many as needed for your plant. Write for Bulletin A.I.G.

W. F. & JOHN BARNES .30 AND .50 CALIBRE RIFLE DRILLING MACHINES

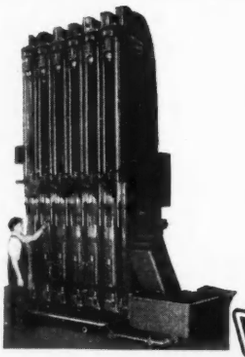
Included in our extensive line of Gun Drilling, Boring and Reaming machines are the two and six spindle machines as described below. If interested in similar machines for larger gun tubes, write for our *complete* set of bulletins.

NO. 410—2 SPINDLE HORIZONTAL

This machine was designed primarily for rifle barrel drilling, but is equally adaptable to diametrically balanced parts such as cam and crankshafts, boring bars etc.



FREE BOOKLET: Write for bulletin A.I.-410.



SIX SPINDLE VERTICAL RIFLE DRILLING MACHINE

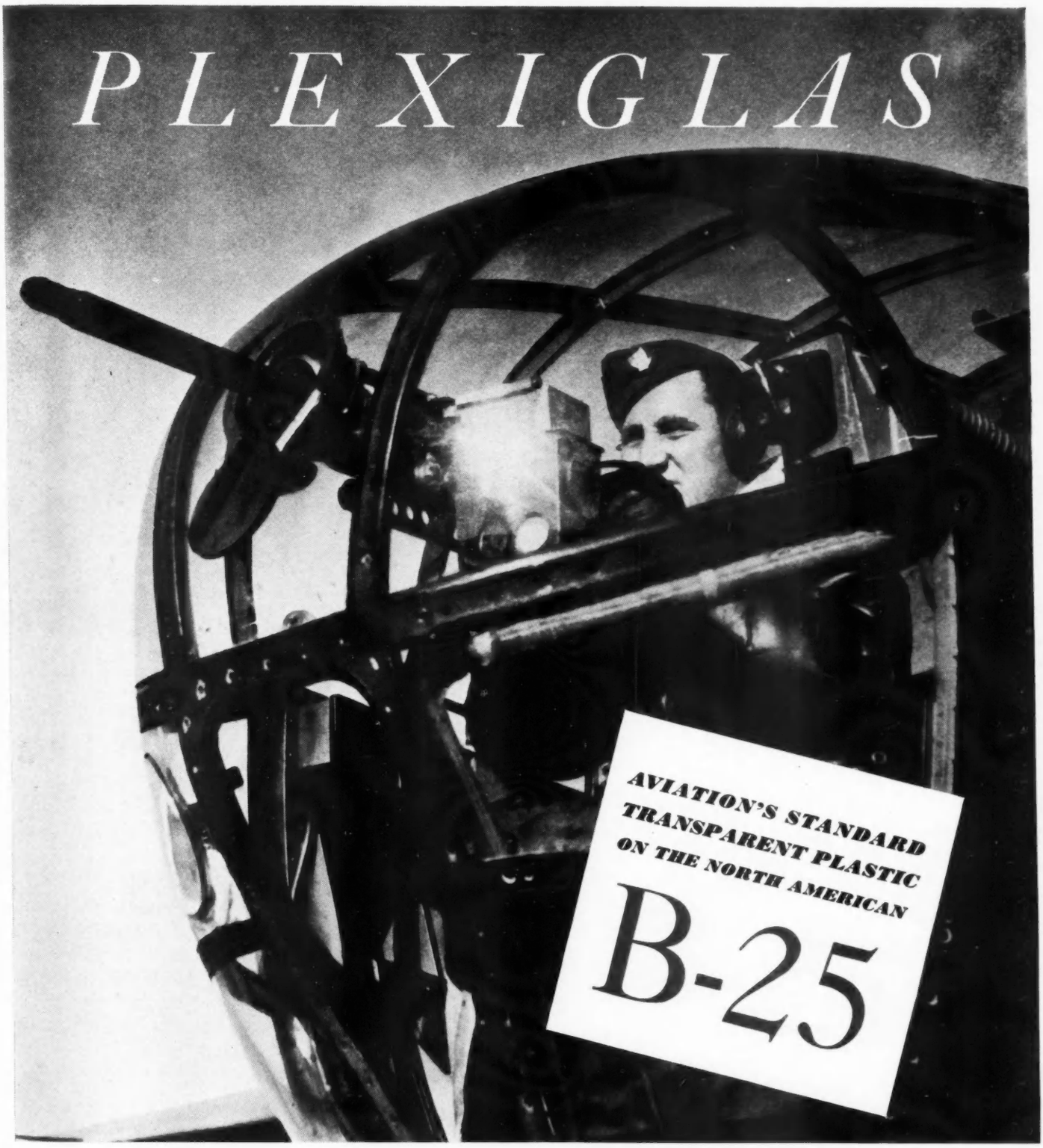
This machine is essentially a unit, designed to drill rifle barrels within a minimum of floor space. Six barrels are machined simultaneously.

FREE CIRCULAR: Write for complete information and specifications. Ask for bulletin A.I.6

W. F. & JOHN BARNES

ROCKFORD ILLINOIS

PLEXIGLAS



YOU'VE got to see 'em before you can shoot 'em.

That's the primary reason PLEXIGLAS is used for nose enclosures, gun turrets, observers' domes and other transparent sections on military aircraft. It is perfectly transparent and permanently clear.

Complete protection is important, too, for the gunner must be able to see and breathe and move his gun in the face of a 400-mile-an-hour slipstream. PLEXIGLAS is as strong as spruce, even in the substratosphere.

Combined with these advantages is the ease with which PLEXIGLAS can be formed to streamlined shapes, its light weight, and its ability to yield with the give and take of the plane.

These important properties, proved by six years of active service, have established PLEXIGLAS as "Aviation's Standard Transparent Plastic."

PLEXIGLAS is the trademark, Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets manufactured by the Rohm & Haas Company.

ROHM & HAAS COMPANY

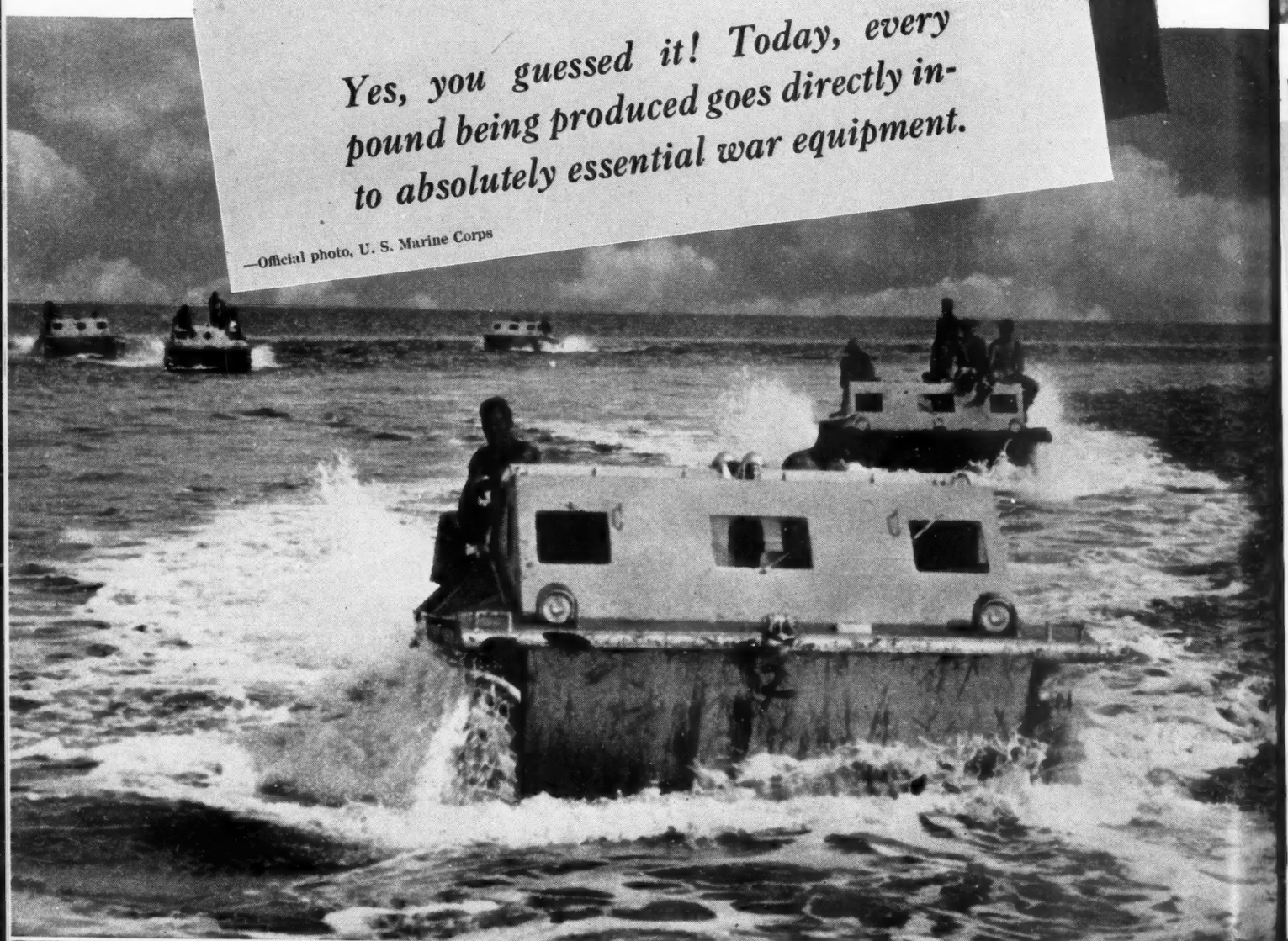
WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Leather and Textile Specialties and Finishes.. Enzymes.. Crystal-Clear Acrylic Plastics.. Synthetic Insecticides.. Fungicides.. and other Industrial Chemicals

Say! What's happened to COR-TEN?

Yes, you guessed it! Today, every pound being produced goes directly into absolutely essential war equipment.

—Official photo, U. S. Marine Corps



UNITED STATES

What's happened to Cor-Ten built equipment?

• What's happened to the 43,000 freight cars built lighter with COR-TEN? What about the thousands of trucks and trailers, the buses, the hundreds of scrapers, bull-dozers, graders, steam shovels and other hard-working industrial equipment that owe their strength and lightness to COR-TEN construction?

The simple answer is that this COR-TEN equipment is doing a whale of a job right now. Because of the dead weight saved by COR-TEN, those lightweight freight cars have made thousands of extra tons of freight capacity available to the railroads. Those trucks and trailers are busy on every highway hauling bonus loads of badly needed supplies. COR-TEN-built buses are carrying more passengers and using less gasoline and are staying longer in service. That earth-moving equipment is right on the job all over the country building airports, preparing new sites for factories and munition plants, working on dams and strategic highways—giving the kind of all-out service the war effort calls for.

Is Cor-Ten coming back for general use again?

• It certainly is! COR-TEN is going to be right back saving weight, increasing strength, making equipment last longer and reducing operating costs when the job it is doing now is done. No steel with such a record of proved performance or with such a potential capacity for making equipment more efficient will ever be permanently withdrawn from the industrial scene. We can promise you that when the post-war battle of competition starts, COR-TEN will be available to help you lift your product above the field.

USS

STEEL

U·S·S High Tensile Steels

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY
Birmingham

Scully Steel Products Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

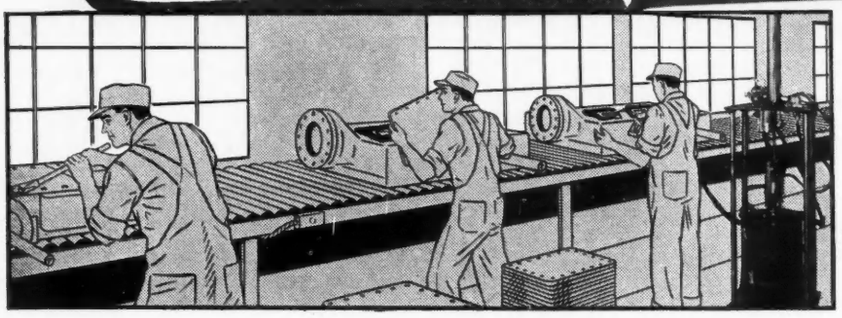
Speed up PRODUCTION

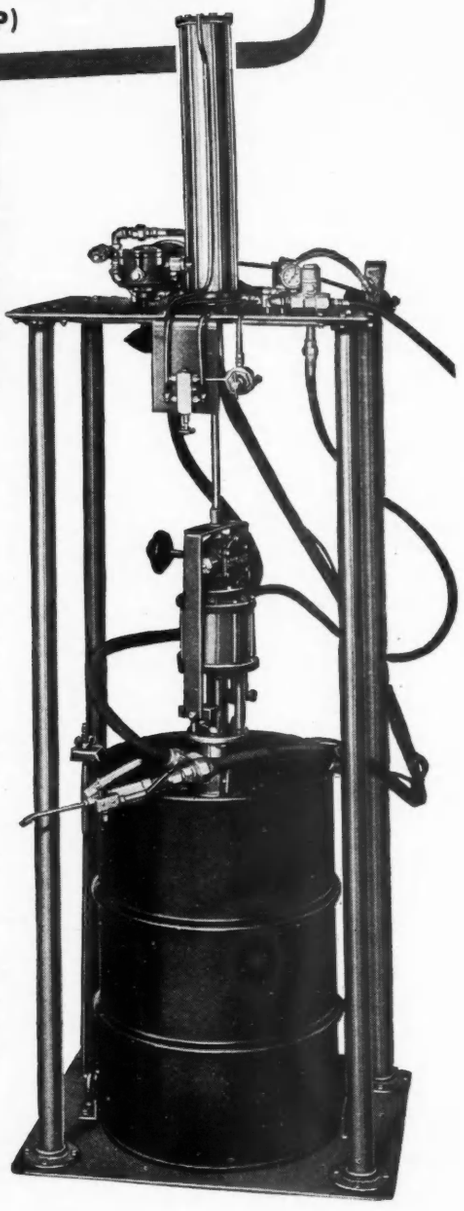
ON YOUR ASSEMBLY LINES—

DISPENSE INSULATION, CAULKING COMPOUNDS AND SEALING MATERIALS *with the*

LINCOLN "PILE DRIVER"

(FORCED-INDUCTION PUMP)





WITH production surging to new highs, the men responsible for keeping schedules on the increase are searching for short cuts and time saving equipment.

Lincoln engineers have recently perfected the Lincoln "Pile Driver." This unique pump is designed to dispense heavy viscous materials such as sealing compounds, sound deadeners, insulating materials, putty, heavy lubricants and other substances too heavy and solid to prime in any other type of pump.

Many of these units are now in service—on production lines where bearings or gears must have initial lubrication—in processes where assemblies must be sealed before riveting—in the production of special war products that must be gas and dust tight—in the refrigerator industry to apply sealing and insulating materials, etc.

Because of the ability of the Lincoln "Pile Driver" to deliver heavy materials direct from original containers to the point of application, this unit saves many man hours and material. Its use does away with the old stuffiing-by-hand, putty-knife and paddle methods of the past and speeds up production. In some cases, one man with a "Pile Driver" can do the work that formerly required several workers when the old methods were used. This saving alone will pay for the equipment in a short while.

Lincoln "Pile Drivers" are available in single or two-stage models, both employing the famous Lincoln Air-Motor. Two sizes can be furnished—the "100" for pumping materials from containers up to 10-gallons (100-lb.) and the "400" for pumping materials from 55-gallon (400-lb.) drums. Each can be arranged as a single stage or a two-stage unit depending on the requirements. The delivery of material is controlled, in both models, by a hand-operated shut-off valve at the outlet, and the flow is always under control of the operator.

BULLETIN 661
describes the Lincoln "Pile Driver" and will be sent upon request.

Special Engineering Service

These new pumps can be adapted to a wide variety of applications. Lincoln industrial engineers will gladly lend their knowledge and make recommendations as to how the "Pile Driver" can serve you.

142-11

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

ST. LOUIS, MISSOURI, U. S. A.

Boeing B-17E Fabricated with Boots Self-Locking Nuts

HOW BOOTS NUTS HELP BOEING WIN THE FIGHT FOR ALTITUDE

The planes that get up highest, fastest, win the air battles. And this is particularly true in high altitude bombers such as the famous Boeing Flying Fortress.

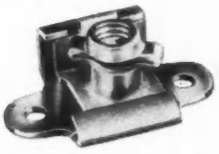
Boeing engineers, aware that lightness in weight means higher ceilings and more speed, specify the demonstrably lighter Boots Self-Locking Nut. This ingenious device insures safe, light connections that stay tight under the most severe vibration.

From the tropical, damp heat of sea level to the intense, dry cold of the sub-stratosphere, Boots Self-Locking Nut easily stands the effect occasioned by such abrupt and violent atmospheric changes.

The Boots Self-Locking Nut contains no organic material—it is all-metal and the locking force is constant. This feature makes it permanent, too. Literally, Boots Nuts "outlast the plane."

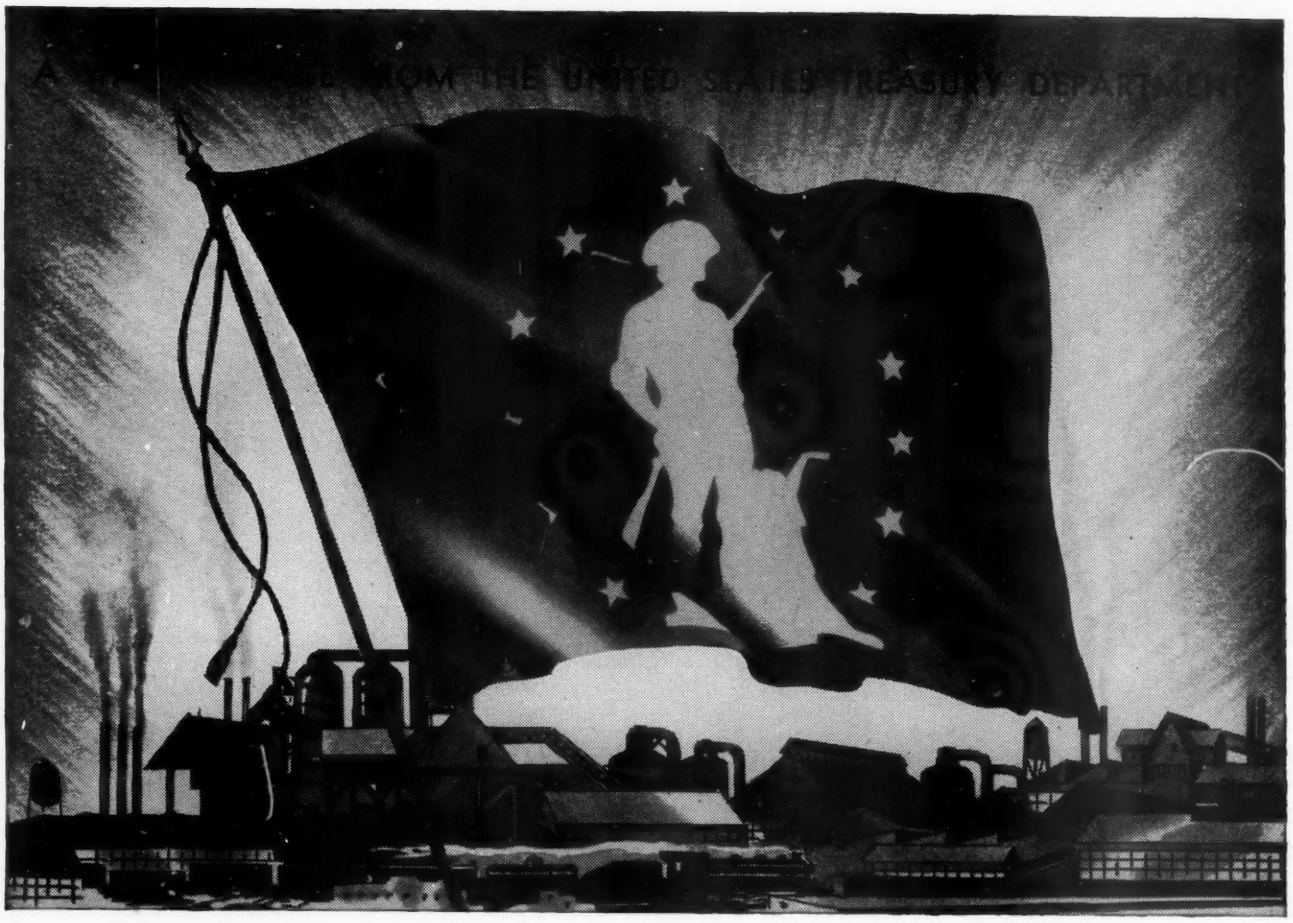
BOOTS

Self-Locking Nuts For Application In All Industries



Boots Floating Anchor Nuts are specifically designed for use where accommodation is desired for possible slight hole misalignment.

BOOTS AIRCRAFT NUT CORPORATION ★ NEW CANAAN, CONNECTICUT



Next to the Stars and Stripes . . .

AS PROUD A FLAG AS INDUSTRY CAN FLY

Signifying 90 Percent or More Employee Participation in the Pay-Roll Savings Plan

IT doesn't go into the smoke of battle, but wherever you see this flag you know that it spells Victory for our boys on the fighting fronts. To everyone, it means that the firm which flies it has attained 90 percent or more employee participation in the Pay-Roll Savings Plan . . . that their employees are turning a part of their earnings into tanks and planes and guns *regularly,* every pay day, through the systematic purchase of U. S. War Bonds.

You don't need to be engaged in war production activity to fly this flag. Any patriotic firm can qualify and make a vital contribution to Victory by making the Pay-Roll Savings Plan available to its employees, and by securing 90 percent or more employee participation. Then notify your State Defense Savings Staff Administrator that you have reached the goal. He will tell you how you may obtain your flag.

If your firm has already installed the Pay-Roll Savings Plan, now is the time to increase your efforts: (1) To secure wider participation and reach the 90-percent goal; (2) to encourage employees to increase their allotments until 10 percent or more of your gross pay roll is subscribed for Bonds. "Token" allotments will not win this war any more than "token" resistance will keep our enemies from our shores, our homes. If your firm has yet to install the Plan, remember, TIME IS SHORT.

Write or wire for full facts and literature on installing your Pay-Roll Savings Plan now. Address Treasury Department, Section D, 709 12th St., NW., Washington, D. C.

Make Every Pay Day "Bond Day"

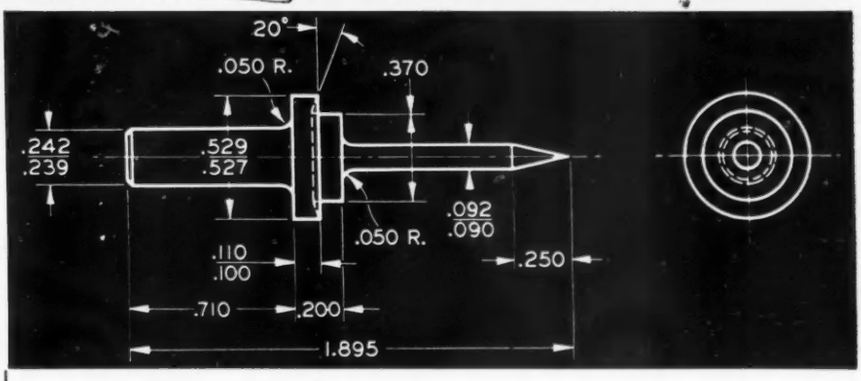
U. S. WAR Bonds ★ Stamps

Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

Efficient Tooling Speeds Output of Striker Pins

Greenlee 1″ Automatic Turns Out 276 Pins Per Hour



Typical of the accuracy and speed with which Greenlee Automatic Screw Machines are turning out hundreds of vital defense parts in the United States, England, and Canada, is this story of the production of an English type fuse striker pin on a 1″ six-spindle Greenlee machine.

This job is an excellent example of how the versatility and tooling possibilities of the modern screw machine can be easily adapted to solve many of today's perplexing production problems.

Tooling for Production Efficiency

To eliminate the possibility of difficulty in forming the pointed end of this part, a small box-type roller turner is used instead of the conventional heavy standard roller turner. With this box-type turner, two tools are used, one for turning the small diameter and one for profile turning the point. The one set of rolls in this turner is sufficient to support the piece during these operations.

Another interesting feature of the tooling set-up for this job is the use of a hollow milling tool for undercutting the shoulder which eliminates the need for a special angular cross-working tool.

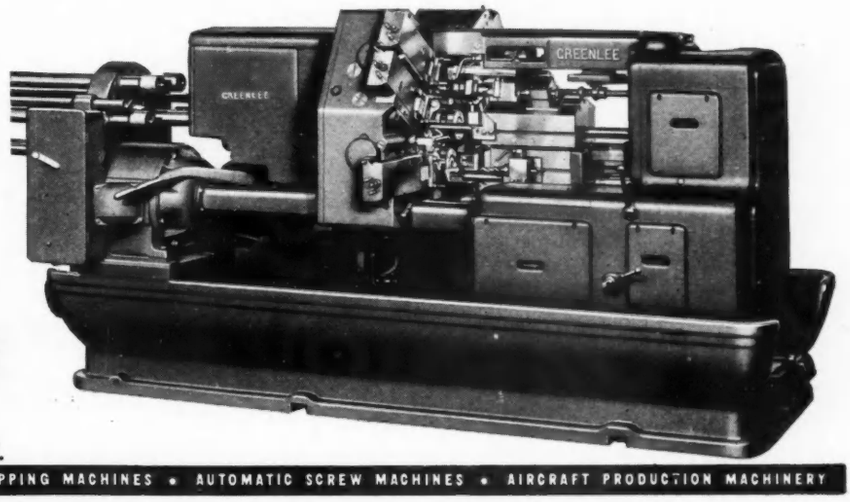
The use of a standard roller turner to finish turn the small .092/.090 diameter probably would result in objectional back-track marks when withdrawing the tool at the end of the cut. It is necessary, therefore, to use another unusual tooling arrangement. A standard die head, operated by a yoke which snaps open the die head at the finish of the cut, is equipped with specially ground chasers to finish-turn this piece.

Production Time Cycle 13 Seconds

The production time cycle for this fuse striker pin, made from 9/16″ round S.A.E. 1112 cold-rolled bars, is 13 seconds. The spindle speed is 1195 R.P.M., the form tool feeds are .0008″ per revolution, with a cut-off feed of .0012″ per revolution for the independently operated cross slides. Turning and endwise-operated tools were fed at .0048″ per revolution.

Sequence of Operations

In the first position the .092/.090 diameter and the point is rough turned with the standard roller turner. In the second position the flange diameter was knee turned and the .092/.090 diameter and point were semi-finished turned with a box type roller turner. In the third position the .242/.239 and the .529/.527 diameters were formed, and the shoulder was undercut with a hollow milling tool. In the fourth position, the .370 diameter is faced, the .050 radius is formed, and the striker point is finished, using roller supports ahead of the finish profile turning tools. The .092/.090 diameter is finish turned with the specially arranged die head in the fifth position. The piece is then cut off in the sixth position.



Greenlee BROS. & CO.
ROCKFORD ILLINOIS U.S.A.

MULTIPLE-SPINDLE DRILLING, BORING, AND TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AIRCRAFT PRODUCTION MACHINERY

BLAKESLEE

METAL PARTS WASHERS

DEGREASERS

BLACOSOLV DEGREASING SOLVENTS

SPIRAL AND BELT TYPE QUENCHERS

ENGINEERED FOR YOU

FOR perfect cleaning of stampings, punchings, deep draws, machined castings, screw machine products use Blakeslee *engineered-for-you* metal parts washers and degreasers. Blakeslee equipment makes it possible to speed up painting, assembly, plating, finishing, and, after quenching, machining, polishing, forming, etc. Let us make a survey of your plant without obligation and submit proposals to help you speed production. Write for free information.

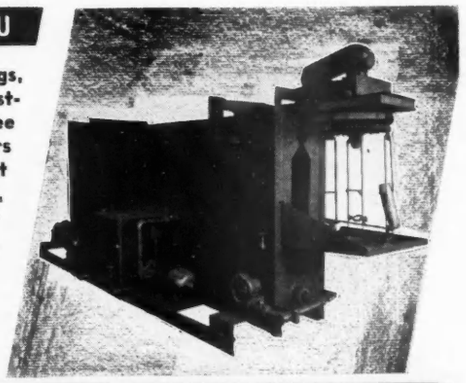


Photo: Blakeslee wash and rinse machine for 105 mm. shells, adaptable for other sized shells.

G. S. BLAKESLEE & CO. MAIN OFFICE & WORKS • CICERO STATION CHICAGO NEW YORK • TORONTO

BUYERS' GUIDE

Automotive Products and Factory Equipment Manufactured by Advertisers in This Issue

See Alphabetical List of Advertisers on page 112

This Buyers' Guide is published as a convenience, and not as part of the advertising contract. Every care will be taken to index correctly. No allowance will be made for errors or failure to insert.

Acid, Sulphuric
New Jersey Zinc Co.

Alloys
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Republic Steel Corp.
Ferro
Climax Molybdenum Co.
New Jersey Zinc Co.
Vanadium Co. of America
Non-Ferrous
Aluminum Co. of America
Mallory & Co., Inc., P. R.
New Jersey Zinc Co.

Analyzers, Combustion
Electro Products Laboratory

Anodes, Electroplating
E. I. du Pont de Nemours & Co.

Arms and Knuckles, Steering
Atlas Drop Forge Co.

Axles
Atlas Drop Forge Co.
National Tube Co., U. S. Steel Corp. Subsidiary

Bearings
Ball
Ahlberg Bearing Mfg. Co.
Brass, Bronze, Sleeve
Johnson Bronze Co.
Roller
Ahlberg Bearing Mfg. Co.
Roller, Tapered
Hyatt Bearing Div. Gen. Motors Corp.
Timken Roller Bearings, Co.

Bearing Blue
Permatex Co., Inc.

Belting Leather
Houghton & Co., E. F.

Belts
Endless (for Engraving Machines)
Preis Engraving Machine Co., H. P.

Bending Rolls
Birdsboro Steel Foundry & Machine Co.

Blanks, Forged
Atlas Drop Forge Co.
Wyman-Gordon Co.

Bolts
National Acme Co.
Republic Steel Corp.

Borers, Jig
Pratt & Whitney Div. Niles-Bement-Pond Co.

Buttons, Push
Benjamin Electric Co.

Camshafts
Atlas Drop Forge Co.

Carriers
Storage Battery
Central Equipment Co.

Casings, Flexible
White Dental Mfg. Co., S. S.

Castings
Aluminum
Aluminum Co. of America
Sterling Aluminum Products, Inc.
Steel
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary

Cement, Cylinder Block
Fabric, Gasket, Pipe Joint, Radiator
Permatex Co., Inc.

Centers, Bench
Barber-Colman Co.

Channels for Glass, Felt
American Felt Co.
Felters Co., Inc.

Chemicals
Automotive
Permatex Co., Inc.
Degreasing
Curran Corp.
Electroplating
E. I. du Pont de Nemours & Co.
Industrial, Leather, Textile
Rohm & Haas Co.

Chucks, Collet
National Acme Co.
Magnetic
Heald Machine Co.

Clamps, Hose (Adjustable)
Central Equipment Co.

Cleaners
Air, Oil Washed
United Specialties Co.
Engine
Curran Corp.
Metal
Detroit Rex Products Co.
Houghton & Co., E. F.
Permatex Co., Inc.
Udylite Company
Vacuum (Portable)
Black & Decker Mfg. Co.
Martindale Electric Co.

Clutches
Industrial
Twin Disc Clutch Co.

Compounds
Electro Products Laboratory
Houghton & Co., E. F.
Permatex Co., Inc.
Petroleum Advisers, Inc.
Udylite Company

Connectors
Plugs
Cannon Electric Development Co.

Connecting Rods
Aluminum Co. of America
Atlas Drop Forge Co.
Wyman-Gordon Co.

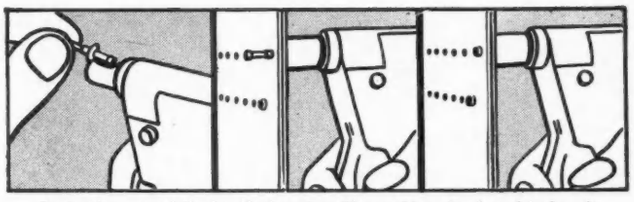
(*Turn to page* 102, *please*)

Cherry Rivets

Here's a one man rivet

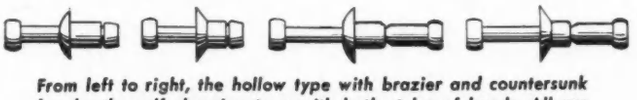
for the hard-to-get-at jobs

Cherry Blind Rivets—flying on American fighter planes on every front—may be just as important for your product. They are true rivets having brazier or countersunk head, and hollow shank through which a double-headed mandril passes.



Projecting mandril of self-plugging Cherry Rivet is placed in head of gun. The rivet extending from head of gun is placed in the work. Pneumatic pull on mandril forms head on the blind side of the rivet, breaks the mandril on the near side and releases gun.

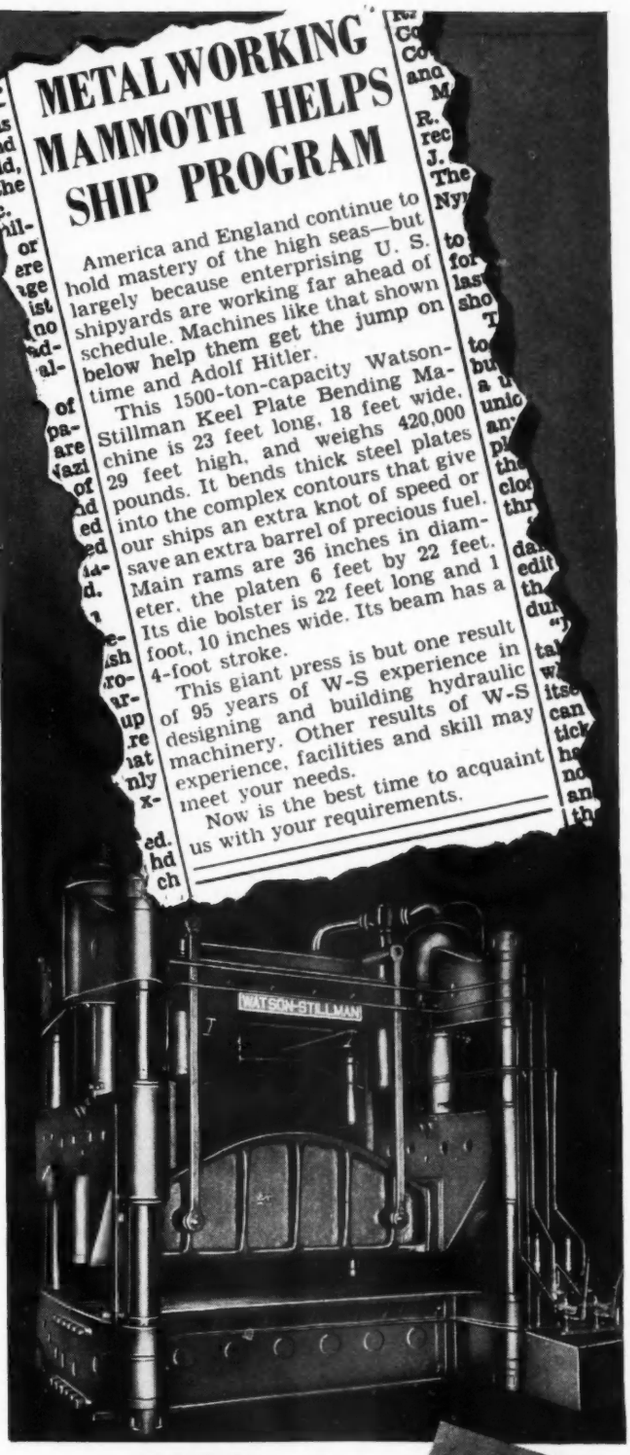
When the rivet is applied with either a hand-operated or pneumatic gun, the mandril forms a tulip head on the blind side. In the hollow type, the mandril flies out of both ends when applied. In the self-plugging type, the mandril automatically and permanently plugs the rivet. The positive mechanical action resulting from high pressure application assures the formation of a satisfactory head on the blind side.



From left to right, the hollow type with brazier and countersunk heads—the self-plugging type with both styles of heads. All are applied with hand or power guns. G-15 Power Gun shown above.

MANUFACTURED UNDER U. S. PATENT NO. 2,183,543

Cherry Rivet
COMPANY
LOS ANGELES, CALIFORNIA


METALWORKING MAMMOTH HELPS SHIP PROGRAM
America and England continue to hold mastery of the high seas—but largely because enterprising U. S. shipyards are working far ahead of schedule. Machines like that shown below help them get the jump on time and Adolf Hitler.
This 1500-ton-capacity Watson-Stillman Keel Plate Bending Machine is 23 feet long, 18 feet wide, 29 feet high, and weighs 420,000 pounds. It bends thick steel plates into the complex contours that give our ships an extra knot of speed or save an extra barrel of precious fuel. Main rams are 36 inches in diameter, the platen 6 feet by 22 feet. Its die bolster is 22 feet long and 1 foot, 10 inches wide. Its beam has a 4-foot stroke.
This giant press is but one result of 95 years of W-S experience in designing and building hydraulic machinery. Other results of W-S experience, facilities and skill may meet your needs.
Now is the best time to acquaint us with your requirements.
WATSON-STILLMAN

FREE!

HYDRAULIC HANDBOOK

Bulletin 120-A—12-page hydraulic engineer's handbook—is yours for the asking. Capacities of Hydraulic Rams; Orifice Discharge of Water; Seamless Pipe Properties; Strengths of Materials; etc., etc. No advertising. Write The Watson-Stillman Co., Roselle, N. J.

WATSON-STILLMAN

Engineers and Manufacturers of Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings

2348

BUYERS' GUIDE– (*Continued from page* 100)

Contact Points
Electric
Mallory & Co., Inc., P. R.

Controls
Arens Controls, Inc.

Conveyor Systems
Mathews Conveyor Co.

Couplings
Flexible
Hansen Mfg. Co.
Pipe & Tubing
Dole Valve Co.

Crankshafts
Atlas Drop Forge Co.
Wyman-Gordon Co.

Cups, Leather
Chicago Rawhide Mfg. Co.

Cutters, Gear
Cylinder Head
Central Equipment Co.
Engraving Machine
Preis Engraving Machine Co., H. P.
Keyseating, Milling
Baker Brothers, Inc.
Barber-Colman Co.
Milling, Boring
Vascoloy-Ramet Corp.

Cylinder Heads
Aluminum
Aluminum Co. of America

Degreasers
Blakeslee & Co., G. S.
Detroit Rex Products Co.

Deflectors, Draft
Dole Valve Co.

Die Heads
National Acme Co.

Die Makers' Supplies
Danly Machine Specialties, Inc.

Dies
Pratt & Whitney Div. Niles-Bement-Pond Co.
Drawing
Vascaloy-Ramet Corp.
Inserts, Hard Carbide
Vascaloy-Ramet Corp.
Sets
Danly Machine Specialties, Inc.

Dovetails
Mitchell Div. United Specialties Co.

Drill Units
Rehnberg-Jacobson Mfg. Co.

Enamels
Engine Touch-up
Permatex Co., Inc.

Engines
Baldwin Locomotive Works
Waukesha Motor Co.
Aircraft
Govro-Nelson Co.

Equipment
Aircraft, Handling
Whiting Corp.
Hydraulic, Anti-icing
Adel Precision Prod. Corp.

Fastening Units
Elastic Stop Nut Corp.
Shakeproof Lock Washer Co.

Feeds, Roll for Punch Press
Littell Machine Co., F. J.

Felt
American Felt Co.
Felters Co., Inc.

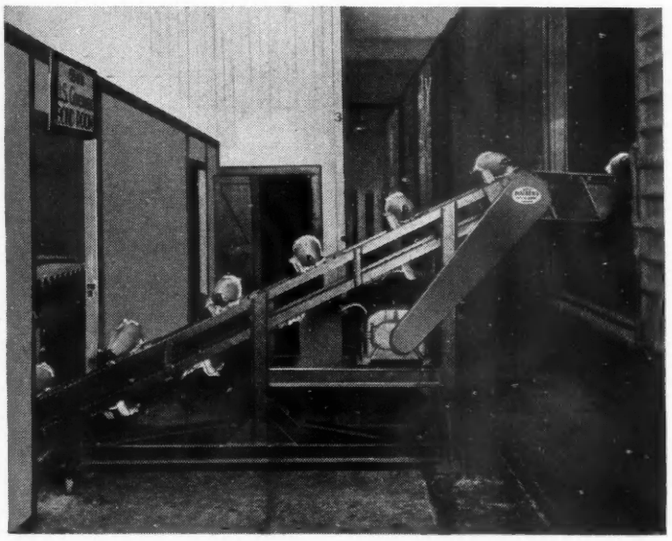
Finishes
Leather & Textile
Rohm & Haas Co.

Forgings
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Wyman-Gordon Co.
Drop
Aluminum Co. of America
Atlas Drop Forge Co.
Wyman-Gordon Co.

Furnaces
Electric
American Bridge Co., U. S. Steel Corp. Subsidiary
Electric—Annealing, Carburizing, Forging, Heat-Treating, Welding
Electric Furnace Co.
Westinghouse Elec. & Mfg. Co.
Gas
Electric Furnace Co.

DOUBLED CAPACITY FOR WAR PRODUCTION

Stepping up our productive capacity month after month has barely enabled us to keep pace with mounting war orders. As long as this condition exists, it becomes increasingly difficult to meet civilian requirements. Our one big job is the handling of war material. That job must come first.



ONE WAY *to Beat* PRODUCTION SCHEDULES

● If you have a difficult production schedule to meet, remember Mathews. Mathews Conveyer Systems have been helping manufacturers to meet . . . and maintain . . . manufacturing schedules that have seemed almost impossible. Your own production problems have difficulties peculiar to your business . . . but it is likely that Mathews has helped some other manufacturer to meet . . . and beat . . . a similar situation. Why not talk it over . . . it could be mutually advantageous.

MATHEWS CONVEYER COMPANY
ELLWOOD CITY, PENNA.
Field Engineers and Sales Offices located in 30 Industrial Centers

BUYERS' GUIDE—*continued*

Heat Treating, Automatic
Electric Furnace Co.

Oil
Electric Furnace Co.

Gages, Electric, Gasoline

Electric, Gasoline, Auto
King-Seeley Corp.

Inspection
Pratt & Whitney Div. Niles-Bement-Pond Co.

Oil Pressure, Water Temperature
King-Seeley Corp.

Precision
Sheffield Gage Corp.

Gasoline
Ethyl Gasoline Corp.

Gaskets

Cork
Victor Mfg. & Gasket Co.

Felt
American Felt Co.
Felters Co., Inc.
Victor Mfg. & Gasket Co.

Fibre
Victor Mfg. & Gasket Co.

Leather
Chicago Rawhide & Mfg. Co.

Metallic Asbestos
Victor Mfg. & Gasket Co.

Gears

Timing, Non-Metallic
Westinghouse Elec. & Mfg. Co.

Grease, Retainers
Victor Mfg. & Gasket Co.

Grinding Machines
Black & Decker Mfg. Co.

Cutter
Barber-Colman Co.

Internal Surface
Heald Machine Co.

Tool, Plain
National Acme Co.

Hammers

Electric, Portable
Black & Decker Mfg. Co.

Soft Face
Martindale Electric Co.

Hand Books

Cold Rolled Strip Steel
Thomas Steel Co.

Heat Treating
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Houghton & Co., E. F.

Hotels

Cleveland
Hotel Cleveland

Philadelphia
Bellevue-Stratford

Instruments

Distributor and Engine Testing
Electro Products Laboratory

Jacks

Car Lifting
Spun Steel Corp.

Lamps
Benjamin Electric Co.

Lathes

Automatic
Gisholt Machine Co.
National Acme Co.

Chucking
National Acme Co.

Chucking, Automatic
Potter & Johnston Machine Co.

Semi-Automatic
National Acme Co.

Turret
Gisholt Machine Co.
National Acme Co.
Potter & Johnston Machine Co.

Lighting

Fluorescent
Westinghouse Elec. & Mfg. Co.

Lubricators, Hand

Central System, Pressure
Lincoln Engineering Co.

Machines

Balancing
Gisholt Machine Co.

Boring
Baker Brothers, Inc.
Barnes Co., W. F., & John
Greenlee Brothers & Co.
Heald Machine Co.

Cleaning and Drying (Metal Parts)
Rehnberg-Jacobson Mfg. Co.

(*Turn to page* 104, *please*)

Fewer Delays
-Fewer Rejects
CMP Precision Strip gives Maximum Parts per 100 pounds

In many wartime industries, where important stamping and drawing operations have been "speeded up", CMP Strip is showing its inherent "extra" advantages. It's nothing new, but superiority always exhibits itself under fire — CMP accuracy, precision and uniformity of desired physical properties in coil after coil has consistently met the most rigid specifications, improved products and generally lowered costs. It takes just this kind of steel today to get maximum uninterrupted production from each vital ton. Again in the certain peacetime tomorrows CMP Strip, as before, will be the solution to many material problems for product betterment. Why not investigate its possibilities for your war products now?

CMP STRIP STEEL
PRECISION COLD ROLLED
THE COLD METAL PRODUCTS COMPANY
Subsidiary of
The Cold Metal Process Company
YOUNGSTOWN, OHIO

HOW CAN CMP HELP YOU?
A wealth of valuable information on cold rolled strip steel, its uses and fabrication, is available from the extensive experience of the CMP personnel—ask a CMP representative or write, wire or phone Youngstown 4-3184.

a 25% speed-up

on the same milling machine

Skilled operators are scarce... and it's hard to add more machines. *But* on many operations you *can* boost output of present equipment 20% to 30% (often more) by utilizing the speed and precision of automatic pneumatic vises!

This Airlox Junior stepped up the milling operation on a machine part 25% for one nationally known manufacturer—and drill press output on small metal parts 30% for another.

Many users are synchronizing operation of the Airlox with the movement of the milling machine table, drill press spindle, etc.

The Junior model has a gripping force of approximately 20 times air pressure. Note its compactness—and its completely enclosed mechanism.

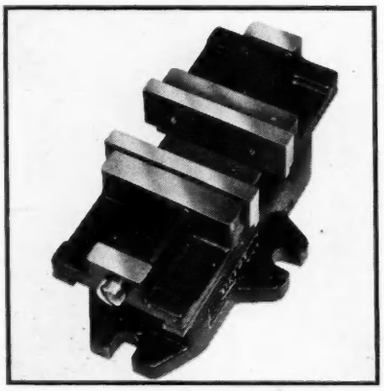
Be sure, when you consider an air-actuated production vise, that it has the speed and gripping force of the Airlox.

There are *six* Airlox models . . . locking pressures 4 to 100 times air line pressures.

Specification sheets will be sent you on request. Or if you wish to send us details of the work to be done, we shall be glad to suggest the type best suited to the job.

AIRLOX

production vises



production devices, inc.

PNEUMATIC PRODUCTION SPECIALISTS

1167 Main Street, East Hartford, Connecticut

1857

BUYERS' GUIDE–

(*Continued from page* 103)

Cutting, Metal
Rehnberg-Jacobson Mfg. Co.

Drilling
Baker Brothers, Inc.
Barnes Co., W. F., & John
Greenlee Brothers & Co.
National Acme Co.
Rehnberg-Jacobson Mfg. Co.

Engraving, Pantographic Etching, Acid Pantographic
Preis Engraving Machine Co., H. P.

Gear Cutting
Barber-Colman Co.

Grinding
(See Grinding Machines)

Hobbing
Barber-Colman Co.

Honing, Cylinder
Barnes Co., W. F., & John
Micromatic Hone Corp.
Sunnen Products Co.

Keyseating
Baker Brothers, Inc.

Milling
(See Milling Machines)

Precision
Sunnen Products Co.

Processing
Detroit Rex Products Co.
Rehnberg-Jacobson Mfg. Co.

Sanding
Black & Decker Mfg. Co.

Screw
Greenlee Brothers & Co.
National Acme Co.
Potter & Johnston Machine Co.

Special
Baker Brothers, Inc.
Greenlee Brothers & Co.
Rehnberg-Jacobson Mfg. Co.

Straightening for Punch Presses
Littell Machine Co., F. J.

Tapping
Baker Brothers, Inc.
Black & Decker Mfg. Co.
Greenlee Brothers & Co.
Rehnberg-Jacobson Mfg. Co.

Testing
Magnaflux Corp.

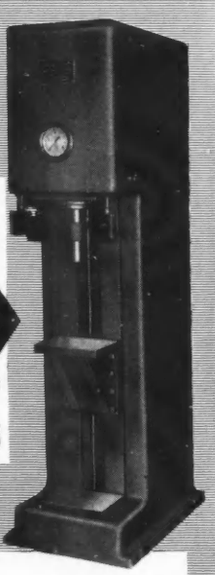
Turret, Automatic
Potter & Johnston Machine Co.

Used and Rebuilt
Emerman & Co., Louis E.

Washing, Metal Parts
Detroit Rex Products

Material

Gear, Non-Metallic
Westinghouse Elec. & Mfg. Co.



QUICK CHANGES HERE SPEED SMALL-LOT PRESSING

DLKC2 HydrOILic KNEE-TYPE PRESS OFFERS RAPID TOOL CHANGING . . . HANDLES WIDE RANGE OF PRESSING OPERATIONS

The ease with which you can retool this DLKC2 HydrOILic press for one job after another is just the *first* thing you'll like about it. Its smooth, flexible *oil hydraulic* power, speed and control give you a new "whip" on production efficiency. The modern cut of its space-saving, projection-free, rounded frame clears the way for fast, accurate, safe operation. And the DLKC2 takes to production-line pressing jobs equally well. This versatile press is built in 5 and 15-ton capacities, with manual or electric control (or both). Maximum stroke is 18 inches; maximum daylight opening, 46 inches. We'll be glad to see that you get full details promptly.

DLOS2-50

DLOS2-100

DLAC2

DLSC2

Write for complete new DATA BOOK on 5 - 15 - 25 - 50 - 100 - ton HydrOILic Presses.

***The* DENISON**
Engineering Co.
1178 Dublin Rd.
Columbus, Ohio

WHEREVER YOU NEED POWER-SPEED-CONTROL *Check*

DENISON EQUIPMENT *for* APPLIED HydrOILics

BUYERS' GUIDE—*continued*

Plastic
du Pont de Nemours & Co., Inc., E. I.
Rohm & Haas Co. (Molded, Sheets, Powders & Rods)

Welding
Lincoln Electric Co.
Mallory & Co., Inc., P. R.

Metals

Spiegeleisen
New Jersey Zinc Co.

Thermostatic
Dole Valve Co.

Milling Machines

Potter & Johnston Machine Co.
Rehnberg-Jacobson Mfg. Co.

Motors, Electric Power

Westinghouse Elec. & Mfg. Co.

Nuts

Boots Aircraft Nut Corp.
Elastic Stop Nut Corp.
National Acme Co.
Republic Steel Corp.

Lock
Palnut Co.

Self-Locking
Boots Aircraft Nut Corp.
Elastic Stop Nut Corp.

Oils

Break-In
Permatex Co., Inc.

Lubricating
Houghton & Co., E. F.
Permatex Co., Inc.

Rust Preventing
Permatex Co., Inc.

Slushing, Quenching
Houghton & Co., E. F.

Packing Sheets

Victor Mfg. & Gasket Co.

Packings

Leather
Chicago Rawhide Mfg. Co.
Houghton & Co., E. F.

Pads, Felt

American Felt Co.
Felters Co., Inc.

Paint

Aluminum
Aluminum Co. of America

Heat Resisting
Permatex Co., Inc.

Paper

Waterproof, Reinforced
Sisalkraft Co.

Parts

Aircraft Engine, Automotive, Precision
Govro-Nelson Co.

Pistons

Aluminum Co. of America
Sterling Aluminum Products, Inc.

Plastic Material

du Pont de Nemours & Co., Inc., E. I.

Plate Planers

Birdsboro Steel Foundry & Machine Co.

Plating

Equipment and Supplies
Udylite Company

Powerplants, Industrial

Waukesha Motor Co.

Pre-Cleaner

United Specialties Co.

Presses

Extruding
Dennison Engineering Co.

Forging, Hydraulic, Metal
Watson-Stillman Co.

Hydraulic (Plastic and Metal)
Birdsboro Steel Foundry & Machine Co.
Dennison Engineering Co.

Power, Steel
Clearing Machine Corp.

Primers, Gasoline

Dole Valve Co.

Pulleys, Belt

Spun Steel Corp.

Radio Accessories

Electro Products Laboratory

Radio Remote Control

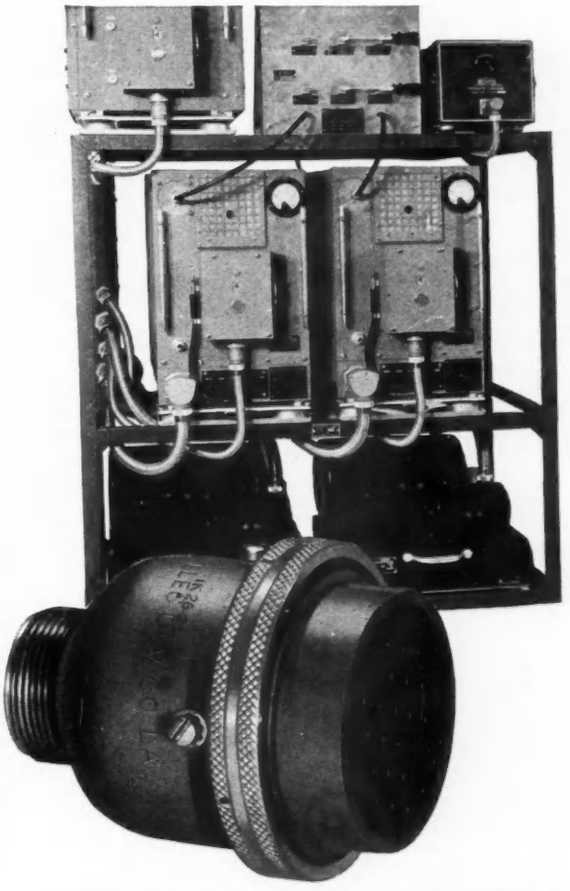
White Dental Mfg. Co.
S. S.

Reamers

Carbide Tipped
Vascoloy-Ramet Corp.

Inserted Tooth
Barber-Colman Co.

(*Turn to page* 106, *please*)



THE EASY WAY

To Make and Break Connections

If you have to disconnect any piece of electrical equipment frequently, the simple way to do it is to use Cannon Plugs.

The Cannon line of connectors includes over 11,000 items. They are standard equipment in American fighting planes, in radio broadcasting, in motion picture studios, and in many other fields where connections must be made quickly and with absolute certainty.

Wherever used, Cannon Plugs do a good job. They have a 27-year heritage of specialized experience. They are built in America's largest and best equipped electrical specialty plant...and, above all, they are built by people who take pride in doing their job well.

CANNON ELECTRIC
DEVELOPMENT CO.
LOS ANGELES, CALIFORNIA

EMERMAN RED BOOK
Machinery Tools and Supplies
EMERMAN
HEADQUARTERS FOR ALL TYPES OF USED METAL WORKING MACHINERY— STAMPING PRESSES—STRUCTURAL TOOLS
LOUIS E. EMERMAN AND COMPANY
1761 ELSTON AVE. CHICAGO TEL. BRUNSWICK 4130
—Also FORGING EQUIPMENT—HYDRAULIC EQUIPMENT
—Our Stock is Large and Varied
—Our Prices Represent Real Values
SEND US YOUR INQUIRIES

NOTE: We are in the market to purchase for cash any of your surplus machine tools.

ONE OF THE FEW FAMOUS HOTELS IN AMERICA
The Bellevue
IS THE GATHERING PLACE
of those who do the important things in business, social and public life. It may be a business meeting, a small dinner, a great banquet, an exclusive party, or a number of each at the same hour—the Bellevue embraces them all in the tremendous capacity of its facilities—each with an intelligent service that leaves nothing to be desired.
BELLEVUE-STRATFORD
PHILADELPHIA
CLAUDE H. BENNETT, General Manager

BUYERS' GUIDE—

(*Continued from page* 105)

Reels, Automatic Centering
Coil Stock
Littell Machine Co., F. J.

Rings, Piston
Muskegon Piston Ring Co.

Rivets
Cherry Rivet Co.
Progressive Mfg. Co.
Republic Steel Corp.

Rust Removers and Preventives
Houghton & Co., E. F.

Saws, Band (Metal-Cutting)
Wells Mfg. Co.
Electric, Portable
Black & Decker Mfg. Co.

Screw Machine Products
Barnes Co., Wallace, Div. Associated Spring Corp.
National Acme Co.
Progressive Mfg. Co.

Screw Stock, Cold Drawn
Union Drawn Steel Div. Republic Steel Corp.

Screws
Cap
National Acme Co.
Machine
National Acme Co.
Progressive Mfg. Co.
Set
National Acme Co.
Thread Cutting, Locking, Sheet Metal
Shakeproof Lock Washer Co.

Seals
Grease
Permatex Co., Inc.
Oil
Chicago Rawhide Mfg. Co.
Permatex Co., Inc.
Victor Mfg. & Gasket Co.

Shafting, Steel
Union Drawn Steel Div. Republic Steel Corp.
Cold Drawn
Union Drawn Steel Div. Republic Steel Corp.
Hollow
National Tube Co., U. S. Steel Corp. Subsidiary

Shafts
Axle and Transmission
Mechanics Universal Joint Div. Borg-Warner Corp.
Flexible
White Dental Mfg. Co., S. S.
Propeller
Mechanics Universal Joint Div. Borg-Warner Corp.

Shims
Victor Mfg. & Gasket Co.
Leather
Chicago Rawhide Mfg. Co.

Signals, Industrial Plant
Benjamin Electric Co.

Solvents
Blakeslee & Co., G. S.
Detroit Rex Products Co.

Springs
Extension, Compression, Torsion or Flat
Barnes Co., Wallace Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson - Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Muehlhausen Spring Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.

(*Turn to page* 108, *please*)

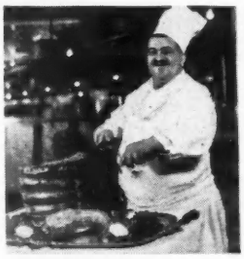
Here's why

CLEVELANDERS PREFER THE CLEVELAND ...AND WHY TRAVELERS AGREE WITH THEM •

★

A genuine interest in your comfort by everyone from manager to doorman.

Food that has made our four restaurants famous.



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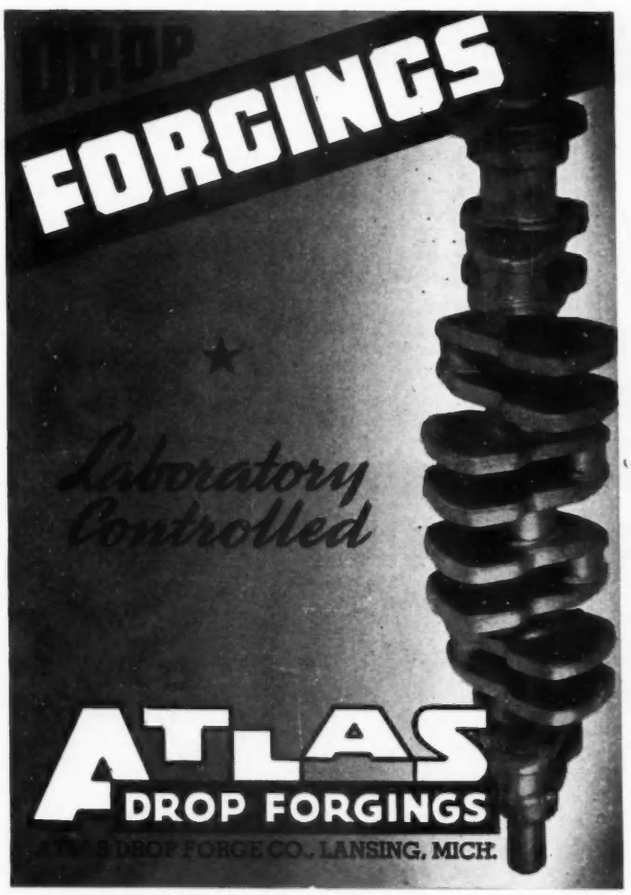

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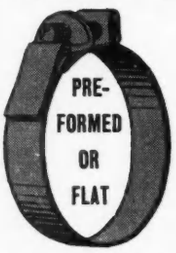

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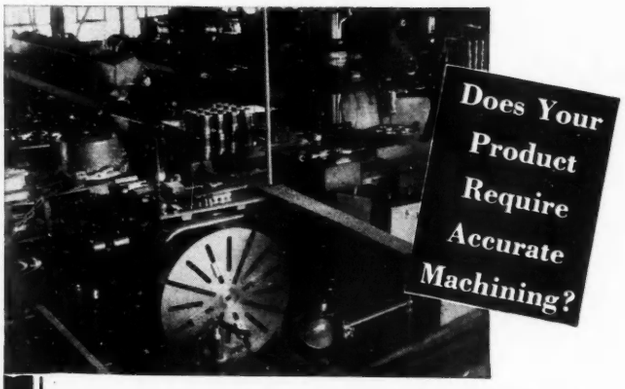

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Benjamin Electric Co.
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Electro Products Laboratory
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Muehlhausen Spring Corp.
Niles Steel Products Div. Republic Steel Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Victor Mfg. & Gasket Co.
Worcester Stamped Metal Co.

Stands, Reel (Coil Stock)

Littell Machine Co., F. J.

Steel

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Republic Steel Corp.

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Union Drawn Steel Div. Republic Steel Corp.

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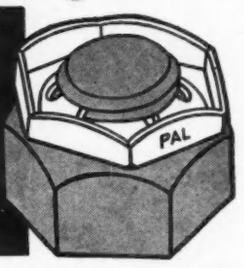

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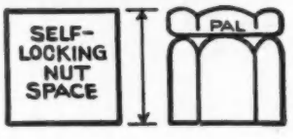

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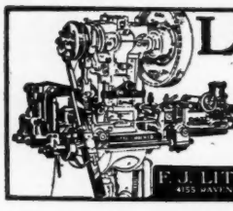

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Sunnen Products Co.

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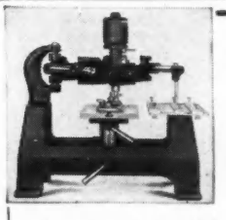

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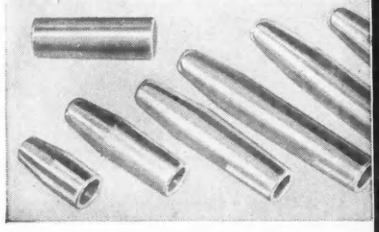
MALLORY STANDARDIZED WELDING ELECTRODES

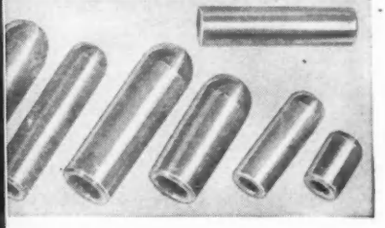
SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST





"Canned Lightning" Wins Its Wings

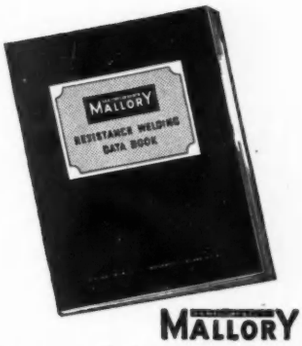
Resistance welding with the "canned lightning" of stored energy machines has certainly won its wings on the production line . . . by permitting more efficient design . . . by assuring faster assembly with fewer men; rivetless and thus lighter structures; and savings in assembly costs up to 90%!

The operator of the spot welding machine above is joining a reinforcing element to the control standard for an airplane wheel column used on a modern warplane. He works faster than a two-man riveting crew . . . and doesn't have to drill holes or use drill jigs or buck rivets. The finished assembly, spot welded, is much less costly, lighter and just as strong and corrosion-resistant as a comparable riveted member.

But modern impulse welding machines and skilled operators couldn't achieve production miracles without the right resistance welding electrodes and holders.

That's where Mallory comes in. Our engineers have spent years of research in the problems of joining many metals and alloys, similar and dissimilar, ferrous and non-ferrous, by resistance welding. We have developed, and production-proved, special electrode alloys and contours, holder designs and cooling methods. We have evolved a standardization program that permits prompt specifying, ordering and shipment of the right electrode and holder for each job . . . for greater speed, more welds between redressings, more welds per electrode, and better resistance welding at lower cost.

Whatever metals you're welding . . . by whatever resistance welding method, spot, seam, flash or butt . . . you'll find that it pays to come to Mallory for the right electrode for each job. Remember, these *standardized* electrodes are available promptly, when you need them.



MALLORY

Resistance Welding Data Book

Be sure your engineering files include this factual, complete treatise on resistance welding practices, alloys and specifications. Write for your copy today.

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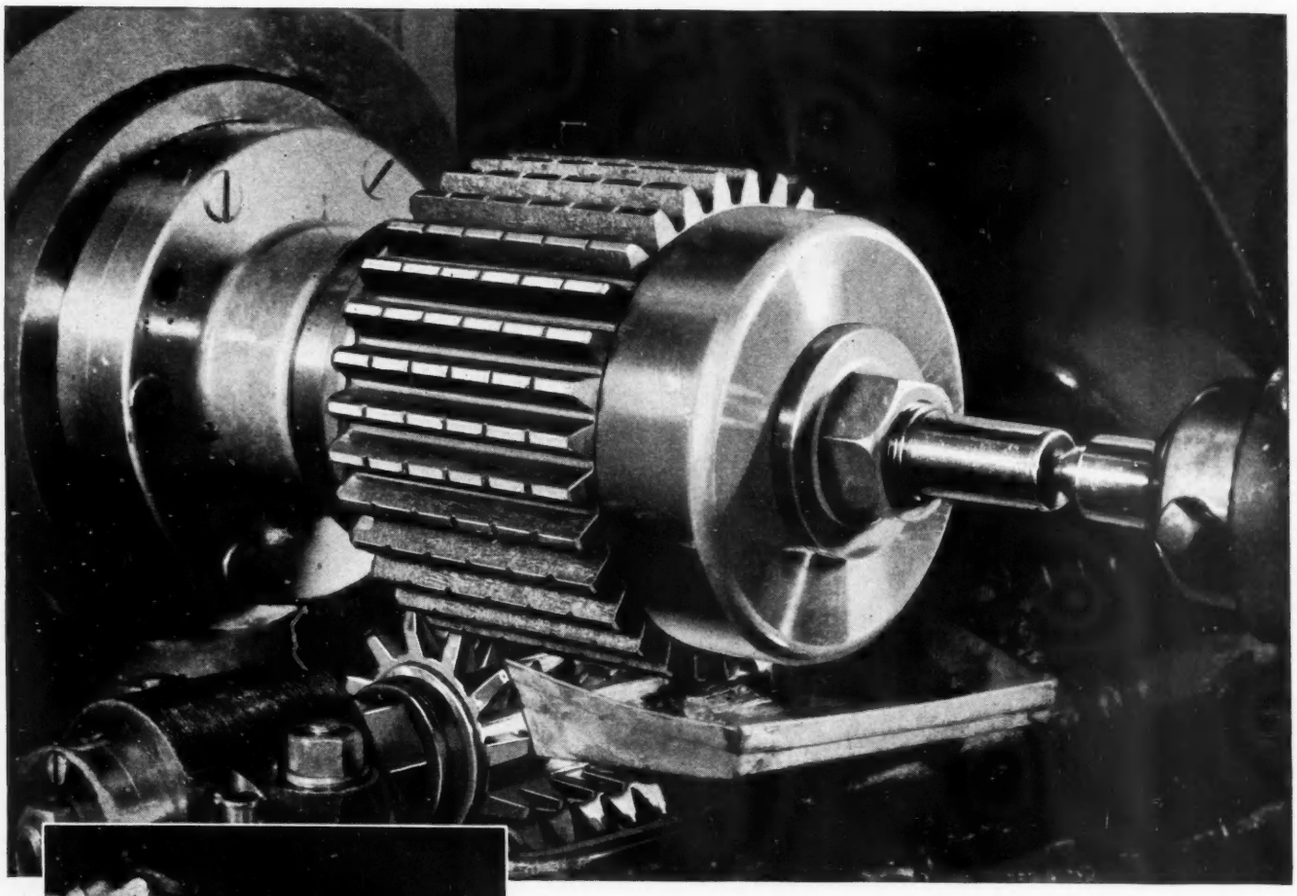
RESISTANCE WELDING P. R. MALLORY & CO. Inc. MALLORY **STANDARDIZED ELECTRODES**



.0002" RUNOUT...

BARBER-COLMAN HOBBING MACHINES HOLD CLOSE LIMITS ON A TOUGH JOB

SUCCESSFUL hobbing, on a production basis, of these tractor transmission fourth-speed ring gears is an excellent demonstration of the inherent over-all accuracy of Barber-Colman Hobbing Machines. With exceptionally close concentricity requirements, large arbors, ground for a snug fit on the inside diameter of the gear blanks and having outer center supports, were used. But, without accurate machines to drive them, these high-precision work-holders would have been wasted. Barber-Colman standard type "A" and type "D" Hobbing Machines successfully filled the bill, the only change being the addition of an auxiliary coolant pump, delivering up to 25 g.p.m.

PRODUCTION DATA FOR THIS GEAR

Size of work — 6.8" O.D., 3/4" face, 32 teeth, 5 pitch, 20° P.A., depth of cut .460".

Material — SAE 4620 steel, 160-175 Brinell.

Accuracy Required — to be within .0002" of runout on pitch line.

Load — 6 blanks, on snug-fitting arbor with outer center support.

Hob — 4" x 4" x 1-1/4" taper hole, single thread, ground.

Machine Set-up — hob speed 174 r.p.m., feed .045" per rev. of work, conventional cut.

Production — 27 min. floor-to-floor, per load of 6 pieces.

Hob Life — 12 pieces per setting, 7 settings, 84 pieces per grind.

WE WANT TO HELP YOU

Barber-Colman Company stands ready to help you toward achieving the greatest possible production capacity, or accuracy or both, from your machines. Call your B-C representative as his practical experience may quickly lead the way to unsuspected opportunities for worth-while gains.

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

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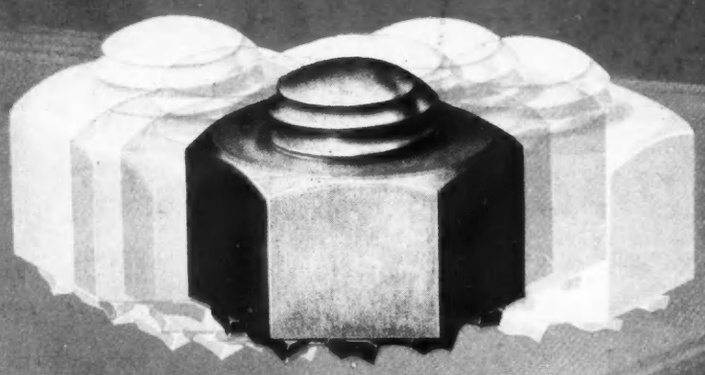
General Offices and Plant 205 Loomis Street, Rockford, Illinois, U. S. A.

VICTORY Over VIBRATION



● Skill! Time! Labor! . . . all are wasted when vibration loosens screws and bolts. But, when EverLocked, the assembly holds. The multiple chisel-like edges dig in and defeat vibration.

EverLock Washers are used and approved by all branches of the Army and Navy. A range of 91 sizes in six standard types are available.

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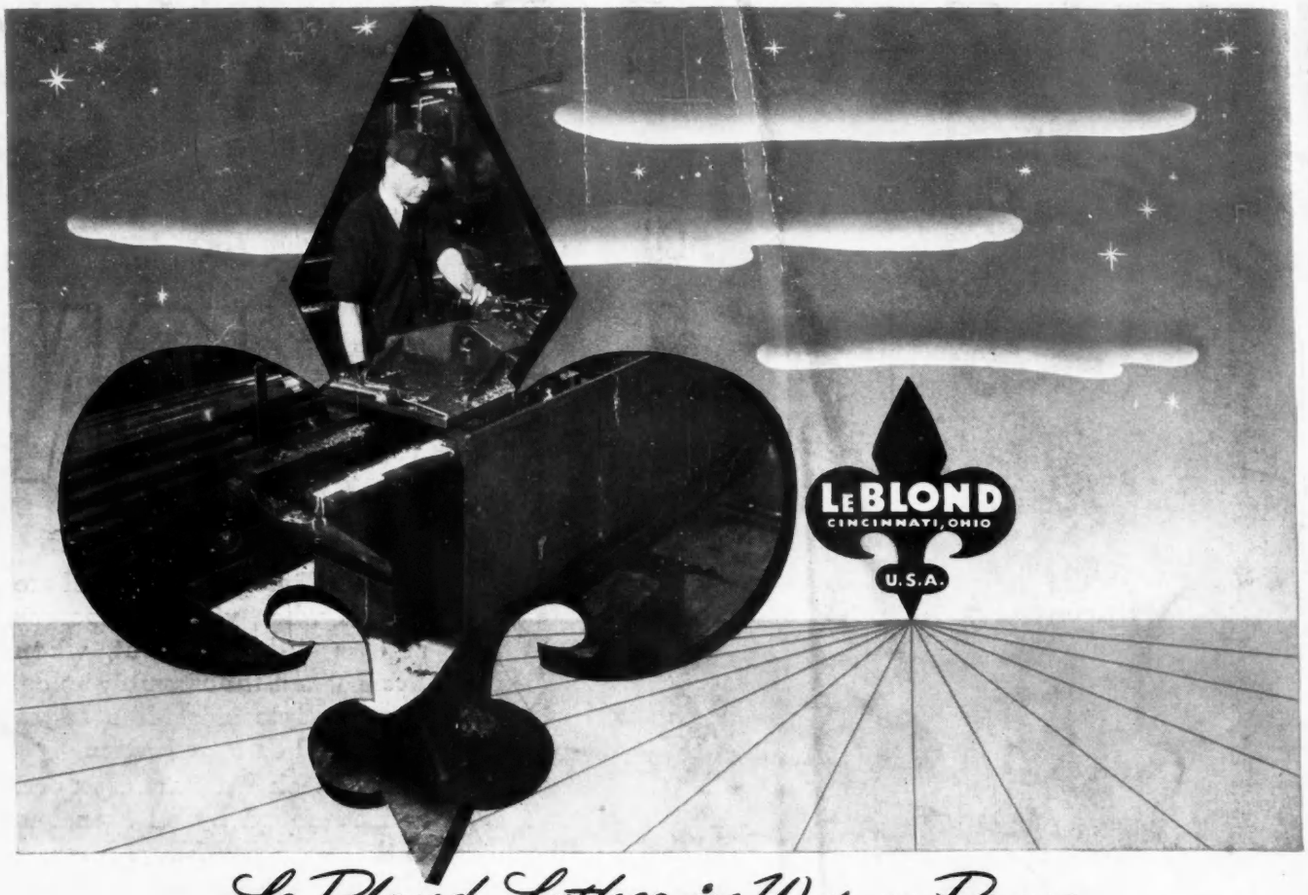

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are dedicated to low cost, high speed, precision turning. Just as highly efficient LeBlond Lathes are now helping speed our victory, so also will they aid in the speedy production of more goods for more people at less cost in the peace that will follow.

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